POCKET ARCHITECTURE: TECHNICAL DESIGN SERIES

STEPHEN EMMITT

DESIGN MANAGEMENT

ROUTLEDGE

PocketArchitecture:
Technical Design Series

Design Management

This is a design guide for architects, engineers and contractors concerning the principles and application of design management. This book addresses the value that design management and design managers contribute to construction projects. As part of the *PocketArchitecture* series, *Design Management* is divided into two parts: Fundamentals and Application. In Part 1, Fundamentals, the chapters address the why, what, how and when questions in a simple and informative style, illustrated with vignettes from design management professionals. In Part 2, case studies from Colombia, Norway and the USA represent unique examples of the application of design management. This book offers a concise overview of design management for postgraduate students and early career design managers.

Stephen Emmitt is an architect and established book author. He is a Professor of Architectural Practice, Director of the Centre for Advanced Studies in Architecture (CASA) and Head of the Department of Architecture and Civil Engineering at the University of Bath, UK. His research and teaching focus on the application of design management in collaborative projects. He is Editor-in-Chief of the international journal *Architectural Engineering and Design Management*.

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Design Management
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"Stephen Emmitt has written a clear, concise and straightforward description of design management, brought alive by vignettes from professionals of their experience and application of design management in industry and through international case studies. It is an essential reference book for anyone working in design or with designers . . . a very enjoyable and accessible read."

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PocketArchitecture:
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Design Management

Stephen Emmitt

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Preface

Although architects and building professionals come into contact with, specify, design and build technical practices every day, they actually know relatively little about them. These are "abstract systems" construed and constructed upon industry norms passed through generations of professionals. Most of them are correct, but many when disassociated with their cultural underpinnings of building vernacular and more importantly, their scientific basis and practice contexts, present challenges that cause buildings to not perform as intended or, worse, lead to physical, economic, or social catastrophe.

PocketArchitecture: Technical Design Series fills this void. The series comprises succinct, easy to use, topic-based volumes that collate in one place unbiased, need-to-know technical information about specific subject areas by expert authors. This series demystifies technical design criteria and solutions. It presents information without overladen theory or anecdotal information. *PocketArchitecture* is on point.

As the name would suggest, the volumes in this series are pocket-sized and collectively serve as a knowledge base on technical subjects in architecture, creating a value-added information base for building novices and masters alike. In addition to architects, engineers and contractors who deliver building projects, the series is appropriate for students and academics interested in accessible information on technical information as it relates to building design and construction.

Despite their size, the series volumes are highly illustrated. Furthermore, the volumes use easily accessible language to succinctly explain the fundamental concepts and then apply these basic ideas to cases of common issues encountered in the built environment. *PocketArchitecture* is essential, accessible and authoritative. This makes it important reading for architectural technologists, architects, building surveyors, building commissioners,

building engineers, other construction professionals and even owners and clients.

This volume, *Design Management*, is written by a thought leader and internationally published author on the subject, Stephen Emmitt. Practice and project management is becoming ever more complex due to the confluence of building technologies and digital practices required to deliver twenty-first-century structures. Offices must employ advanced business methods, knowledge management and interpersonal relations to successfully deliver on construction projects today. This volume emphasizes design managers' technical and interpersonal skills in leading and managing people and processes, with the underlying goal of delivering maximum value to the client. As part of the *PocketArchitecture Series* the book includes both fundamentals and advanced topics. It is appropriate for the novice and expert practitioner as its content is fresh and well considered in the field of texts on design management.

Ryan E. Smith
Senior Editor

Acknowledgements

I would like to thank the contributors to the vignettes and the case study chapters for their valuable input. To state the obvious, I could not have completed this book without you. The individual views provide a unique insight into the world of design management, and it is necessary to state that the views expressed are the views of the contributors, and may not necessarily reflect the views of their employers.

I am grateful to the series editor, Ryan E. Smith, who asked me to contribute with a book on design management. It has been an enjoyable challenge to express the main aspects of design management in such a concise format.

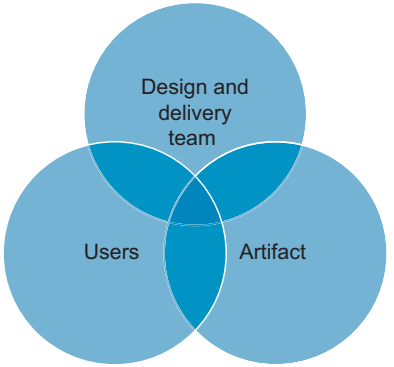
I would also like to acknowledge the many individuals, practitioners, academics and students with whom I have discussed the whys and wherefores of design management over the years. Too numerous to mention, these conversations have shaped my thinking, writing and application of design management.

Introduction

ALTHOUGH DESIGN MANAGEMENT has existed both as a discipline and a field of knowledge since the 1960s it is only since the turn of the twenty-first century that design management has been accepted as a means of delivering value to construction clients. Changes in procurement routes, shifting responsibility for design, rapid developments in digital technologies and ever more demanding clients have combined to emphasize the need to better manage design. This applies to all aspects of design, ranging from the management of designers and design information to design tools, technologies and processes.

The rapid uptake of design management demonstrates that design quality is foremost in the minds of building sponsors, project participants, owners and users alike. Combined with exciting developments in information technologies, such as building information modeling (BIM), off-site production and a more inclusive approach to the management of projects via collaborative and integrated project delivery methods, we are experiencing rapid and positive change in how we design, deliver, use and reuse our built environment. This change is also having a positive effect on the drive for a more inclusive and sustainable (low-carbon) built environment in which design is an important factor. This means that design, both as an activity (designing) and as an output (design information), must be managed to maximize design quality, deliver buildings in an efficient manner and, most importantly, realize buildings that are a delight to use.

This brings us to the issue of performance in architecture, construction and engineering (ACE). This can be expressed in three interrelated ways by the performance of: the design and delivery team(s); the completed artifact; and the users of the building. (see Figure I.1).The management of design plays an important role in ensuring efficient delivery by the design and construction teams; it influences the final quality of the building and its technical and functional performance; and it influences how people perform within



1.1 Performance on three levels

and around the building. Combined, these performance drivers highlight the need for a systematic and consistent approach to the management of designers and design information. We do not need more management, or more managers. We need better management practices and procedures that are responsive and supportive of creative individuals and creative processes and managers with a passion for design. The emphasis should be on people and processes, with the underlying goal of delivering maximum value to the client: the theme of this book.

There are a variety of definitions of design management and design manager to be found within the literature. The situation is similar in practice, although the terms and definitions used tend to be specific to a particular organization and the country in which it is based. Combined, the definitions relate either entirely to the management of designers, or more usually to the management of design information with an emphasis on design integration. Many of these definitions have their roots in, and draw on, project management. For clarity the definitions used in this book for design management and design manager are:

- Design management is the management of design information *and* the management of designers in a *team environment* – that is it concerns people and processes.
- Design managers are responsible for delivering design quality.

This book addresses the value that design management and design managers contribute to all phases of construction projects. The book differs from the small number of books currently available by presenting information in a concise and accessible format that resembles a guide, or concise handbook, rather than a narrative. Consistent with the *Pocket Architecture* series, this book is divided into two parts: Fundamentals and Application. In Part 1, Fundamentals, the five chapters address the why, what, how and when questions in a simple and informative style. Vignettes from design management professionals are included to further illustrate specific issues:

1 Design management fundamentals

This chapter sets out the fundamentals of design management, starting with definitions and moving on to identifying different levels of design management within organizations. The vignette is contributed by **Clive Robertson**, who argues for a strategic approach to design management.

2 Preconstruction – generating design value

The two most important aspects of any project are the project definition (client briefing) and the team assembly stages. This is where the true value of design management lies. **Ben Bourke** provides the vignette about the value of design management at the preconstruction phase.

3 Construction – delivering design value

Constructors deliver the design value to the client, and this chapter looks at the management of design from the perspective of the constructors. **John Eynon** reflects via the vignette on a career as a design manager.

4 Working together – valuing design interactions

Design management is primarily concerned with managing people, and the focus in this chapter is on how people interact in temporary project environments. In the vignette **Lanre Gbolade** discusses the challenge of coordinating and liaising with multiple stakeholders.

5 The design manager

Our focus in this chapter is on the individual design manager. We look at the different job roles, the need to establish the design manager's

remit within projects, personal characteristics and the need for consistency across projects and organizations. Vignettes are provided by **Susan Snaddon**, **Robert Toon** and **Nicolas Gill** and address design integration, the factors that motivate design managers and working overseas respectively.

In Part 2, the case study chapters provide unique examples of application of design management. Contributors are drawn from Colombia, Norway and the US to give a broad insight into the evolving world of design management.

6 Shining light on the dark side

by Dave Beem

Dave Beem describes his move from an architectural practice into the world of design management, a world often referred to as the dark side. He identifies a general lack of knowledge about design management in the US while also extolling the virtues of design management. Dave has found light on the dark side.

7 Beck Group: an integrated approach

by Rick del Monte

Rick del Monte provides a comprehensive overview of the integrated approach adopted by the Beck Group. He reflects on two recent projects, concluding with lessons for others to learn from.

8 Veidekke: collaborative planning in design

by Vegard Knotten and Fredrik Svalestuen

Scandinavia has long been recognized for its democratic and inclusive approach to life and business. In this case study the emphasis is on collaborative planning and the approach taken by Veidekke as part of their design management strategy.

9 ARPRO: project delivery in emerging markets — a case study from Colombia

by Rodrigo Rubio-Vollert

Developing countries, such as Colombia, face the challenge of integrating global knowledge and practices with local ones. In the final chapter Rodrigo Rubio-Vollert describes the challenges of applying international

knowledge to a local context. He concludes with an overview of a joint venture between organizations based in Colombia and Canada to deliver an innovative building in the center of Bogotá.

Whether readers are new to design management or are experienced in its application, this book encourages everyone involved in the design, delivery and operation of our built environment to learn more about design management. Design management provides considerable value to building sponsors/owners, organizations and users; it is worth applying and adapting to one's unique circumstances. Design management will bring about better efficiency in organizations and projects; it will result in better delivery and better quality buildings; it will result in better performance of buildings and a more satisfying experience for building users; it will add value to organizations and individuals.

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Fundamentals

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chapter 1

Design management fundamentals

IN THIS CHAPTER the fundamentals of design management are explained and illustrated to set the context for the chapters that follow. We start with explaining what design management is – that is what it is we are managing and why. Then we explore the different levels of design management from an architecture, engineering and construction (AEC) perspective. This is followed by a review of different design management roles and the business of design. We then turn our attention to managing six fundamental aspects of design: design activities, design data, design processes, technologies, people and expectations.

Design management: what it is

CLIENTS EXPECT THEIR PROJECTS to be delivered effectively and efficiently by their project delivery teams. Clients demand and should expect:

- A consistent level of service
- Certainty over build cost
- Certainty over program
- Assurance about the quality of the completed artifact
- An artifact that performs as designed during its service life
- An artifact with minimal negative impact on our environment.

These demands and expectations are influenced by the decisions made by the design and delivery teams within an appropriate managerial framework for a project. Underlying all decisions is design (with a small 'd'), and all of the client demands just listed are influenced by the way in which the designers and constructors interact and their collective performance.

Design is a creative activity. Creativity comes from the fear of failure, or more accurately the luxury of failure. It concerns the exploration of possibilities and opportunities, testing different solutions to see what works and what does not, and embracing the better solutions to come to a workable proposition. This is an iterative process often involving a large number of participants. In architecture, engineering and construction, design is concerned with translating wants and needs from the world of clients to the world of constructors and building users. The remit of designers is to constantly draw out the unexpected and create value. The work of the constructors is to translate the value codified in design information into a built artifact. It is the constructor who delivers the value. Of course this is a rather simplistic view because many stakeholders are involved in the cocreation of design, ranging from clients and building users to specialist subcontractors, suppliers and trades.

The creation and delivery of design value are often a lengthy and complex series of interactions, lasting many years for the larger projects. The entire process needs to be managed to keep process waste to a minimum and to ensure that the maximum possible value is delivered to the client and building users. Project managers, design managers and construction managers are typically the primary actors in this process. It is the design management team that is responsible for the design aspects of the project.

The word 'design' may be interpreted in many different ways, and therefore it is necessary to use some definitions to ensure everyone understands what is being 'managed'.

The *verb* **design** is concerned with doing various activities that fall under the umbrella of designing – creating something new. When designing we are using cognitive and social skills, thinking and interacting with others in the cocreation of design. This involves communicating and making decisions in a collaborative group or team environment, using the most appropriate technologies and tools to hand. This helps to eliminate uncertainty about what is required to resolve design clashes and is fundamental to the creation and delivery of design value.

The *noun* **design** describes the output of the design process. Initially this is codified in design information (drawings, specifications, models and calculations) and then translated by the constructor into a physical artifact.

The *verb* **manage** is concerned with doing various activities that fall under the umbrella of managing. Similar to when we are designing, when

we are managing we are using cognitive and social skills to forecast, plan, coordinate and direct people towards a common goal. This also involves communicating and making decisions in a collaborative group or team environment, using the most appropriate technologies and tools to hand. This helps to eliminate uncertainty about what is required from the designers and constructors. Management, like design, is fundamental to the creation and delivery of design value.

The *noun* **management** is usually used to describe managerial systems and processes that are put in place to allow people to achieve their tasks safely and efficiently. The word 'management' is often used as a synonym for administration, although management is more correctly concerned with setting goals and controlling the means to achieve them.

Putting design and management together we get **design management**.

Definition

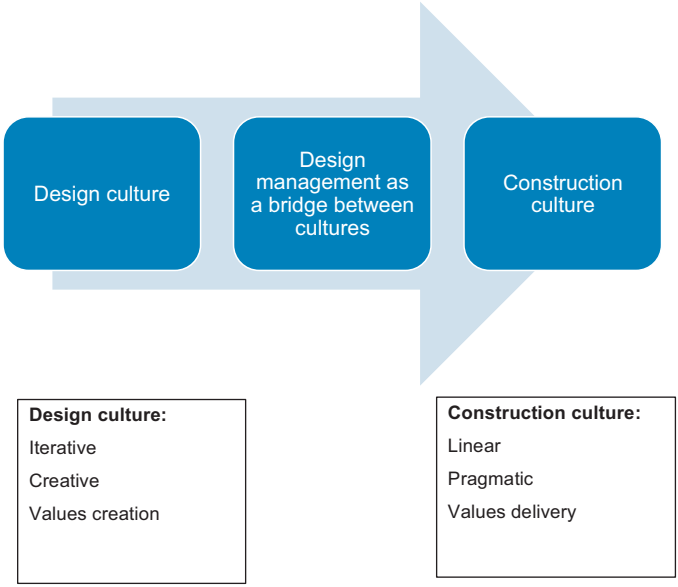
Design management is the management of design information *and* the management of designers in a *team environment*.

Design management comprises the convergence of two cultures, the culture of design and the culture of management. Although the two cultures use different language, fundamentally they are not dissimilar. Design is concerned with exploring and shaping solutions to problems, as is management. Designers are concerned with bringing many disparate elements together to realize the bigger picture, as is management. Design managers need to understand how designers and constructors work; they also need to understand management principles and techniques. This emphasizes a need for commercial awareness – the business of design (discussed ahead).

Definition

Design managers are responsible for delivering design quality.

Design managers can be found throughout construction, working for clients, developers, designers, engineers and contractors. The term 'design manager' is used quite broadly to encapsulate a bridging role between design and its delivery (see Figure 1.1). Design managers work alongside project managers, often undertaking similar tasks, but their primary goal is to achieve design quality



1.1 Design management – integrating cultures

throughout the life of a project. Design managers must have an understanding of and love for design in addition to knowledge of contractual procedures and regulatory compliance. They must have exceptional coordination and communication skills. Activities primarily relate to managing the following:

- Timely production of accurate design information. This is achieved by nurturing a collaborative and integrated working environment.
- Effective flow of information to those who need it. This is achieved through the effective mapping and management of the design supply chain.

Levels of design management

THE ROOTS OF DESIGN MANAGEMENT can be traced back to the 1960s, with early work conducted by the architectural profession in the UK. Parallel work

into industrial (generic) design management started to develop around a similar time, with early publications also going back to the 1960s (see 'Further Reading'). Constructors started to take interest some 30 years later as they became ever more responsible for design quality. The constructors realized that they had to do something different if they were to manage design quality; hence the construction design manager role was born out of necessity. Since the turn of the century the number of design managers employed by constructors around the world has grown at a staggering rate. This is in marked contrast to a relatively modest uptake in design management within the architectural and engineering fraternity, where design managers are mainly found in large multidisciplinary organizations. Needless to say the application of design management is still evolving within the architectural engineering and construction (AEC) sector. Not surprisingly, many questions remain as to the extent to which design management is used within organizations.

The Design Management Europe Network (www.designmanagementexcellence.com) has developed a 'design management staircase' that graphically illustrates how organizations use design management in their businesses, ranging from no design management at the lowest level rising to the top level, where design management is an integral part of the business culture. This work has been adapted to make it relevant to organizations working in AEC and is shown in Table 1.1. Readers should ask themselves where they are currently positioned and where they wish to be positioned in the future.

Table 1.1 Levels of design management in AEC

Level 1: no design management At this level there is no, or very little, knowledge of how to manage design. There is no consistent approach to the management of design within the organization or across its portfolio of projects. Design is not part of the organization's culture and the management of design tends to be undertaken 'if necessary' and in an informal, ad hoc manner.
Level 2: design management applied only to projects The understanding and application of design management are restricted solely to individual projects. This tends to be where many contracting organizations are currently positioned, with design managers primarily located on construction sites. This could be viewed as a 'reactive' approach, with design managers employed to address challenges created earlier in the preconstruction phase, such as the coordination of design information, requests for information and design changes. Design management is not integrated into business processes or office culture.

(*continued*)

Table 1.1 continued

Level 3: design management used proactively
At this level there is an understanding of the importance of design management within the business. Design forms part of the business processes and there are efforts to manage design at an organizational and project level. Senior design managers will oversee the project portfolio and link performance of projects to the business. At this level architects, engineers and constructors will employ design managers as a link between the design team and the construction team. Contractors will employ preconstruction design managers to proactively deal with design-related challenges before they create problems on the construction site. Taking a proactive stance will allow the design and construction teams to deliver better design value compared to those positioned at Level 2; it will also result in fewer issues to address during construction.

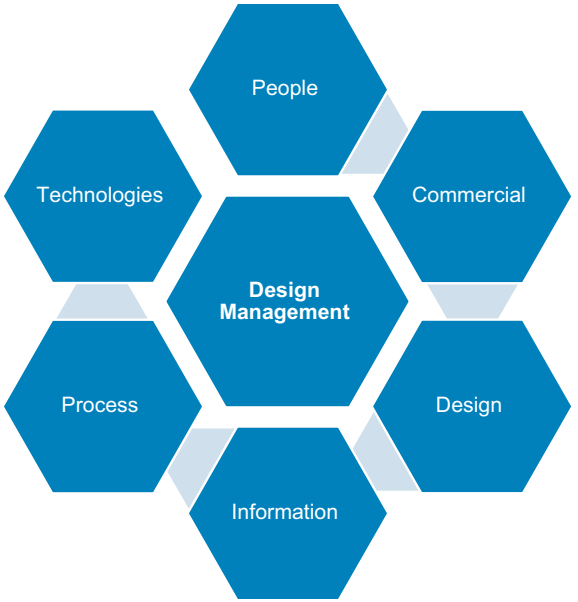
Level 4: design management as culture – strategic design management
At this level organizations will be design-driven with design embedded in all business processes. Design management will be central to the culture of the business, forming the glue between the project portfolio and the business. Design management will have strategic importance to the business, and profitability will be determined by the effectiveness of design management across every aspect of the business. This allows the organization to embrace process innovations, such as lean thinking and integrated project delivery, as part of its design management activities. At this level clients should expect projects to be delivered on time, on budget and to agreed quality levels. More importantly, the organization will deliver excellent design value to its client and building users.

Elements of design management

THERE ARE A NUMBER OF ELEMENTS that make up the design management discipline, as illustrated in Figure 1.2. All of these factors influence the ability to generate and deliver design value to the client and building users. Understanding the interaction of these elements in a project and organizational environment is an essential skill. These six elements are discussed ahead.

Commercial factors: The business of design

Understanding the value of design to an organization and its clients is fundamental to a successful business. The interrelationship between effective management of design within an organization and effective design within that organization's portfolio of projects will determine the level of productivity and profitability of the organization. It is essential that design managers



1.2 Elements of design management

understand the commercial climate in which they operate. Commercial factors primarily relate to the following:

- Business aspects of individual projects. This is often expressed in terms of cost, but it should be seen in a wider context of delivering design value to the client. The manner in which designers interact, how they produce information and the quality of that information all have implications for the commercial success of a project.
- Business objectives of the organization. This is often expressed in terms of profitability, but it should be seen in a wider context of delivering value to society.

Without a sound understanding of the commercial factors relating to both, often competing interests, it is unlikely that individuals will be particularly

effective in the design management role. This requires a higher level of understanding and application, as indicated on the levels of design management (Table 1.1).

Many of the decisions taken by design managers will be colored by project finances and the implications for their organization's economic fortunes (in terms of managing the organization's resources). Understanding the interrelationship between project decisions and the implications for the financial well-being of the organizations contributing to the project is a fundamental requirement. So too is an understanding of the commercial decisions that ensure building projects are commissioned and seen through to a successful completion. Designers who are able to add value to their clients' projects will be rewarded with future commissions. Adding value may be tangible, such as delivering the project ahead of schedule or being able to design in more useable floor space. It may, however, be intangible in terms of how appealing the building is to potential investors.

Managing design activity

The act of design is a complex undertaking, involving interaction with many other designers in a highly dynamic and often fragile network of temporary relationships. The design manager must ensure that the best possible environment for encouraging interaction and collaborative design exists within the organization and within every project. How this is done will vary depending on the design manager's specific organizational context and his or her personal preferences. A strategic overview is required for every project. There are some underlying factors to address that relate to the following:

- Physical collocation of designers (to discuss issues face-to-face). This is expensive to organize, and it is not always possible due to project logistics and/or the global location of project participants.
- Virtual location of designers. It is relatively easy to communicate and collaborate via information communication technologies (ICTs) and using 'big room' technologies, but it is also too easy to miss the informal interactions and body language that give clues to how we really feel.
- Design management tools to be used. The value of one over another will depend on the project context and the market orientation of the

organization concerned. It may also be determined by the individual preferences of the design manager for certain types of tools and approaches. The important point to note is that tools alone will not achieve effective design management. It is also necessary to employ design managers with the experience, knowledge and interpersonal skills to interact effectively with colleagues in their organization and project stakeholders. One of the most comprehensive sources of information for design managers can be found at www.projectdesignguides.com.

Managing design information and its flow

The output of the design process is a set of design information (e.g. drawings/specifications/calculations/models) that will be used by others to construct the building. The drawings and specifications show the constructors what is required and the interrelationship of the various elements of the design. The design information does not tell the constructors how to build; that is the responsibility of the construction team. However, without accurate design information the constructors are left to 'guess' what is required, which unnecessarily increases risk to the constructor, which is reflected in higher costs and unnecessary conflict.

Collaborative digital platforms allow design managers to better manage design information, helping to reduce clashes between architectural and engineering elements of the design and reduce the number of unresolved issues before the work starts on site. This results in fewer requests for information (RFIs) compared to more traditional, less well-coordinated methods of handling design data. Greater transparency of data will, inevitably, result in fewer requests for design changes. It is, however, of little use letting everyone have everything all at once because we would all be swamped with the sheer volume and complexity of the information. Thus it is necessary to forecast the following:

- Who requires what information? This question can be answered only by understanding the temporary project organization and the goals of the specific project. The management tools associated with BIM will help to define information requirements early in the project. As the project evolves these requirements will need to be revisited and adjusted accordingly.

- Why do they require the information? At a basic level this relates to whether people require information to be able to design or construct buildings, as the needs will be different. However, there are quite subtle boundaries within projects that help to define what specific requirements are. The better these are managed, the more effective are the individuals working with that information.
- When do they require that information? Understanding the flow of work within organizations and within projects will assist design managers with answering this question. Mapping the flow of information and the delivery of design work packages will be helpful in managing information requirements.

Managing the design process

Process models and frameworks are essential to allow all designers to understand their position, roles and responsibilities in relation to others. Process guides are essential tools for design managers. A wide range of process plans is available to guide designers through the design and build process. These range from simple descriptions to detailed step-by-step guides. The best known are provided by the American Institute of Architects (AIA) and the Royal Institute of British Architects (RIBA). Alternative and complementary process guides can be found in, for example, the discipline of value management, where the focus is on identifying and then delivering value to the client.

All design projects, regardless of size and complexity, pass through four key phases. These are summarized in Table 1.2 and discussed in a design management context. The effective identification and management of these major interfaces are an essential task of design and project managers, and are discussed further in Chapter 4. The important point to make is that each phase involves different skill sets, and inevitably the individuals involved will change as the project moves from inception to delivery and use.

Process plans help guide individuals through the design and construction process. Each project must have a bespoke process plan that is suitable to, and appropriate for, the project context. The process plan should facilitate effective and efficient design work, communication and information flow, and learning. This means that the process needs to be first mapped and then designed to suit the project requirements. This will help to inform the design and construction programs. It will also help to eliminate process waste,

Table 1.2 Phases in the design process

1. **Project definition: inception, client briefing and procurement**
   At the project definition stage the key value parameters are established. It is through the briefing process that the users' wants and needs are explored and understanding is achieved. It is here that the client's business plan is established and the procurement route decided. Design quality will need to be discussed and appropriate parameters agreed. Failure to conduct a comprehensive briefing process will usually lead to design changes and cost uncertainty later in the project. The briefing process also starts to establish connections with a variety of organizations and individuals that may form the project team. Establishing the brief, understanding what is required and putting the right people together to deliver the project will help to ensure a relatively straightforward project (see Chapters 2 and 4). Failure to do this effectively will lead to problems later in the project.

2. **Project design: generating design value**
   The outcome of the briefing process, the brief, sets out what is required and serves to inform and steer the design team. At this stage more people join the temporary project organization, comprising managers, cost consultants and designers to explore solutions to the given challenge. During the development of the design it is inevitable that it will change as designers and engineers work to maximize design value and minimize waste. Therefore some attempt must be made to manage the design process as the design evolves and the parameters set out in the project brief are challenged (and in some cases redefined). As a general rule of thumb, the later the design change occurs in the process, the greater the implication (cost and time) of accommodating that change. This phase should conclude with accurate and complete design information. This will be accompanied by accurate cost and program information and with all legal and environmental approvals in place. For schemes with a high degree of off-site manufacturing it is essential that the design is reviewed and approved prior to manufacturing, although one could also extend this argument to more traditional forms of construction. In terms of efficiency and reducing uncertainty it is necessary to complete the design information, review it and approve it before entering the construction phase. This allows for accurate bidding by contractors and subcontractors and accurate construction (see Chapter 2).

3. **Project delivery: construction, delivering design value**
   At the project delivery phase there is a change in the culture of those contributing to the project, moving from a creative to a pragmatic mindset. Design information will be 'consumed' by the constructors and interpreted into a physical artifact. The construction design manager will be working alongside the project managers and the construction managers to ensure that design quality is maintained and the building complies with relevant permissions and standards. Cost and time tend to take priority as the constructors aim to deliver the project safely and to agreed quality parameters (see Chapter 3).

4. **Product operation: use, maintenance and recovery**
   Buildings will require regular maintenance, repair and upgrading to suit changing user needs. Feedback from building maintenance managers and facility managers can be used for the development of new projects, helping to integrate important experience and knowledge of how buildings are used and how they perform over time. Once the building becomes obsolete, it will need to be remodeled or demolished and materials recovered, recycled and/or reused in a new artifact. And so the process starts once again, albeit from a different point in time and with different stakeholders.

the focus of the lean thinking philosophy. Process plans should include, as a minimum:

- Clearly defined stages, roles, tasks and responsibilities (design decision matrix)
- Meetings and workshops
- Value and risk management workshops at strategic intervals
- Project milestones (for the design team and the delivery team)
- Last responsible moment for decision making
- Control gateways to coincide with the end/start of different phases
- Learning opportunities and feedback loops.

Managing technologies

As the design management role has evolved and matured so too have the digital technologies that underlie design and realization. It is now possible to communicate with all project stakeholders via dedicated project intranets and associated information communication technologies (ICTs). We can design in a collaborative manner via a shared virtual building information model, using a variety of building information modeling and building information management software (BIMs). This information can be linked directly to manufacturing plants to produce bespoke building components and products.

Given the variety of commercially available software and the preferences of individual organizations for one over another, it is essential that individual projects are set up with shared technologies, preferably the same technologies. A number of fundamental questions need to be addressed at the project initiation stage:

- What are the most appropriate technologies for the project?
- How do the project technologies interface with each stakeholder's organizational needs?

A number of tools are available that help in this regard, such as BIM protocol. It is, however, essential that the various options and preferences are discussed within the project team and a collective decision taken. The decision should not be imposed on the project team by the project manager without prior consultation as this may lead to inefficiencies and in the worst cases

organizations running parallel systems, the familiar one in their organization and the unfamiliar one via the project. Inevitably, this will create unnecessary interoperability issues and unnecessary work. We must not rely entirely on the technologies; they are only as good as the people inputting, manipulating and interpreting the data.

Managing people

At the heart of the design management discipline is the ability to effectively manage people. This calls for an understanding of how people behave in general terms and also an understanding of how individual project contributors are likely to behave during the course of the project. This is crucial because research has shown that we all respond differently during the various phases of a project, sometimes being more efficient than others and sometimes feeling less stressed than others. We all have our preferred way of communicating and interfacing with others. We all respond differently to various managerial approaches. We all have good and not so good days at work, and although we do not like to admit it we all do, occasionally, make mistakes. We are not machines; our performance levels may vary significantly during, for example, the course of a week. While there is not much a design manager can do about inconsistent individual performance levels, he or she can be prepared by building a certain amount of flexibility into programs and recognizing that one approach will not suit all. An appreciation and understanding of the behavior are an essential requirement.

The design and construction 'teams' are extremely diverse, and ensuring an appropriate level of interaction to develop and realize the design is challenging. The following questions should be addressed:

- Who are the most appropriate people for the project? The emphasis should be on key individuals as much as it is on organizations.
- What individual skills, knowledge and abilities do the individuals bring to the project?
- What value do the individuals add to the project?
- Are they compatible with the overall project ethos and with the other members of the project team?
- Are they leaders or followers?
- Can they be trusted to deliver?

Design managers need to have empathy with the people they manage. Understanding what motivates individuals and their goal orientation will help design managers to deliver design value (see Chapter 5).

Vignette – a case for strategic design management

Clive Robertson
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Design is generic and a part of everyday life and something that everybody wants to be involved with one way or another. Be it cooking or making a sandwich, you are designing. Be it drawing or contributing to a design decision, you are designing. The initial design that started as a few lines on a napkin over dinner with the owner eventually becomes a design project with many parties contributing to the design. Moving up to the megaproject level the design and delivery team becomes very large, with hundreds of people from many disciplines working on the project over a long period. Regardless of project size and complexity, the design manager has a responsibility to manage the design process effectively, ever mindful that 'design' and 'designing' are not well understood within the entire project team.

My career has spanned 35 years, starting in architectural practice as a designer and moving into design management as my career developed, working extensively in the Middle East on megaprojects over the past decade. During this time I have witnessed early incarnations of the design manager, which was little more than a glorified document controller, transform into an established and respected role. What is too frequently overlooked in a BIM-driven project environment is that the iterative design process still needs to be managed, regardless of the technologies used. Architects often wish to manage their design teams without 'external management' taking the responsibility away from them. However, the majority of lead architects now realize that the design manager needs the lead designer and they, in turn, need the design manager. It is a team approach. The design manager provides a comprehensive and supportive understanding to the complete design process. It is the design manager who establishes a common set of project objectives; generates an understanding and knowledge of the project; educates; reduces risk; encourages strategic decisions and unequivocally improves the delivery of design quality.

Look more closely and we see a shift in the design manager role from the construction site to the preconstruction phase, where strategic decisions and planning combined with effective communication are key factors. Complaints from clients about the quality of the buildings (expressed in numerous government reports the world over) can be addressed only at an early stage in the project. Design management needs to move to the executive board level in organizations, and hence form part of the strategic business plan. The problem that developers face is that although they may require a green, state-of-the-art building that they can sell or put to immediate use, they have to evaluate where to begin. With a strategic design management approach the evaluation would have already commenced. I favor a strategic design management approach because not all clients and contractors have a true understanding of design and the technologies required to deliver design value.

Encouraging all stakeholders to communicate with one another is one of the many tasks that a design manager has to fulfil. Stakeholder management is the most important element within any project of any size and complexity. There is a diverse and different type of clientele on every project. Consulting and supporting clients in different ways to produce a structured and well-detailed brief, along with an appropriate procurement route, are fundamental to project success.

Programming design team activities is also something that architects rarely do. It is up to the design manager to take a strategic view of the 'assault course' and manage the process to ensure that design value is not lost at the many obstacles along the route to project completion. The iterative design process must be strategically managed because it involves everyone from project inception to completion, use and beyond. Design programming would appear to be missing or misunderstood by constructors. The design team usually provides a detailed design program that is subsequently 'rationalized' by the contractor to suit their working methods. This is done without adequate knowledge of the design durations and design dependencies, which inevitably results in delays and claims.

To conclude, I believe that everyone entering the construction sector should be taught the basics of managing design, which of course includes an understanding of design and designing. Design management education is a modern by-product of design and technology, construction and manufacturing trades. Therefore, it should be introduced as an apprenticeship. As the technologies evolve and we move more towards prefabrication and

off-site construction, we will need fewer construction project managers, which will be replaced by design managers. We need a new strategic design management framework. The principles, processes and protocols would be generic to all projects, helping to reduce the uncertainty (and the associated risks and costs); I am currently researching and working towards this goal.

chapter 2

Preconstruction – generating design value

IT IS WELL KNOWN that the two most important aspects of a project relate to (1) understanding and defining what is required and (2) the assembly of the most appropriate organizations and individuals to deliver the project. The first aspect relates to client briefing and the establishment of a comprehensive project brief. Get this wrong and it is very difficult to achieve the value required by the client. This can lead to frustration and disputes as well as a physical artifact that does not function in the way it was intended. The second aspect involves the considered selection of compatible project participants to design and subsequently construct the project in accordance with the project brief. Get this wrong and it becomes very difficult to deliver the project on time, on cost and to agreed quality levels. This can lead to ineffective communication, disputes and poor-quality buildings. Many challenges encountered on construction sites can be traced back to poor understanding of the client's requirements and project participants failing to interact effectively. The message is to go slow to go fast – that is get everything in place and agreed by the client before starting to do the work.

In this chapter emphasis is on the way in which design activity is managed to generate the best possible value for the building sponsor (client) during the major design phases (e.g. AIA stages and RIBA stages). The design manager's role varies considerably at the precontract stage, dependent on the market orientation of the organizations involved and the type of procurement route being used on a specific project. At this early stage the design manager needs to consider how the strategic decisions will minimize the operational decisions. It is the design manager's job to oversee design quality and the coordination of design information. The primary function is to maximize design value for the client. It is not the design manager's job to do the design; others are employed for that task.

Design value

INVESTORS AND OWNERS of buildings invest in design to generate value for their businesses. It is the designers who explore, expose and articulate the wants and needs of the client via the briefing process and transfer those into a design proposal. It is this process that generates value for the building owner and users. Value is influenced by:

- A whole-life approach to design management (including low-carbon and resilient design)
- Design briefing (and optioneering)
- Design development (including target value design)
- Specifying design quality
- Design for construction (including on-site and off-site considerations)
- Design management responsibilities.

Value, like quality, means different things to different people, and hence the term needs to be discussed to arrive at a shared understanding for each project. This can be achieved by following a defined value management plan or included in the project plan. Defining value is primarily related to the initial briefing process, where value should be discussed, explored and defined. Values of the project participants also need to be discussed to ensure a degree of compatibility and shared project values.

Value management

Value management and value-based management models are based on the discussion and agreement of values, primarily, but not exclusively via facilitated workshops. Consensus and the creation of trust are fundamental components of these models. Workshops start with team assembly prior to the briefing stage and continue to project completion and feedback. Interactions within the workshops encourage open communication and knowledge sharing while trying to respect and manage the chaotic nature of the design process. Cooperation, communication, knowledge sharing and learning as a group help to contribute to the clarification and confirmation of project values. Getting to know fellow actors and developing trusting relationships are essential features of the approach. Value engineering is a subset of value

management, where tools are used to interrogate all aspects of the design to ensure maximum value is delivered to the client for the least cost. This is discussed further in Chapter 3.

Design briefing

A CRUCIAL STAGE in any project is establishing an understanding of what is required and why. In construction this means getting to know the sponsor of the building project, the client, and making the effort to understand their needs, likes and wants, and just as importantly what they do not like. This process is usually termed the briefing process or the employer requirement capture phase. The outcome of the briefing process is a series of documents known collectively as the brief. These documents are used as a guide by the design team to explore and develop the design. The briefing documents are a record of the client's requirements, and thus they will need to be referred to and updated as necessary throughout the project. The project brief will be a contractual document in the majority of contracts.

Briefing is, unfortunately, an aspect of projects that is too often poorly managed. Thus the design team starts designing based on incomplete or misleading information, often resulting in the need to revisit designs and to take more time than would otherwise be required. This is process waste that eats into the profitability of the design team. And not surprisingly, many of the challenges to be found in the realization phase can be traced back to ineffective briefing – that is not spending enough effort on clearly establishing what is required and why. This will invariably result in requests for changes and requests for information (which take time to deal with) and thus the cost and time parameters will be compromised. In the worst cases the inability to clearly define the brief will lead to negative conflict and disputes.

Too often clients and their advisers work with a very vague brief to 'get things moving' and often pay the price at a later stage, having to rework designs and drawings, and in the worst cases dismantle and rebuild parts of the building. It follows that an essential aspect of design management is to capture the client's needs *before* design work commences. Failure to do so will result in wasted effort, unnecessary cost and project overruns.

Exploring client needs – steps to success

It is crucial that clients are able to set out their demands in detail, with a clear vision for the building and a clear set of business benefits. The majority of clients, perhaps with the exception of repeat clients and clients with large building portfolios, will need guidance and assistance with this. Brief takers must be able to quickly establish empathy with the client and also have the ability to question initial statements of need. This requires excellent interpersonal skills as well as extensive experience of design and construction projects. Management of the briefing process is an essential tool in the design manager's toolbox. Effective management of the process will result in less uncertainty and the reduction of risk. There are a number of discrete steps in the briefing process that need to be managed and that have a degree of iteration between them.

1 Establishing the business case – why?

This is the most important part of the project, establishing the answer to the question, why? The commercial aspects of the project will be expressed in a project business plan or a strategic brief. This will set out the reasoning for the project, together with the financial and time constraints.

2 Establishing project requirements – what?

Once the business case has been established, and approved by the client, attention turns to what is required. This usually involves discussing the project requirements in an increasing level of detail, which once approved are set out in the briefing documents. A variety of terms are used to describe the written documents that define the client's requirements, the most common being 'project brief', which is used here for consistency.

3 Establishing the project team – how?

As the briefing process develops and the main project requirements start to be established, there will, inevitably, be discussion about the skills required to deliver the project. These are the early discussions about team assembly, colored by major decisions – for example to use off-site manufacturing or a certain type of procurement route, such as relational contracting.

4 Establishing the project program – when?

The business case will have established the financial constraints for the project and also one or more critical dates. However, it is only when the

project requirements are confirmed and the main decisions relating to how the project is to be delivered that the main dates and hence the program can be established with any certainty. Failure to establish clear and unambiguous project requirements, together with the means of delivery, will result in an inaccurate program and subsequent problems with the delivery of the project to program. The design management program will sit under the overall project program and will need to be coordinated with the construction program, as discussed later.

5 Client approval (sign-off)

Given the importance of the briefing documents it is essential that the client approves and signs off these documents in accordance with the agreed timescale. Once the documents have been approved, they can be issued to the design team. The client will also need to approve any subsequent changes to the brief.

6 Communicating the brief to the design team

Sending a large volume of information to the design team without any form of social interaction with the client and/or briefing team is not recommended. No matter how good we are at expressing the client's needs in the briefing documents it is very difficult to convey the spirit of the client to the design team. The briefing documents should be handed over to the design team via the brief taker and, if possible, the client. Meetings or workshops can be instrumental in helping to reduce uncertainty and aid understanding. Although such events are time-consuming, the payback is a more efficient and better-informed design process.

7 Monitoring

Monitoring the brief throughout the design and construction process is essential to ensure client expectations are met. Failure to monitor the development of the design and the development of the build against the brief is likely to lead to disputes with the client, because what was delivered has deviated from what was required.

8 Learning

Briefing is a process of learning for the client and the brief takers. Given the intensity of the questioning process it is inevitable that the client

will know more about its requirements at the end of the process compared to the start. Similarly, the brief takers will have developed an in-depth understanding of how the client goes about its business and the aspects of the project that are most precious to it. For repeat projects and clients with large property portfolios the learning is crucial to informing the efficiency of the process.

The project quality plan

ONCE THE BUSINESS case (strategic brief) and the project brief have been established it is then possible to define the project quality plan in accordance with the quality assurance procedures. The project quality plan is an essential tool to help steer the project to a successful conclusion. The aim is to give the client and project participants confidence in the service provided. The project quality plan sets out what will be done and by whom. The best project quality plans are usually those produced as a result of a collaborative exercise by the main participants. This is possible only if these are known at an early stage. Producing the quality plan via consensus helps to ensure the document contains information that has been discussed and agreed (thus helping to avoid future conflict). This is also a useful step in starting to build a project team ethos. Along with the project brief the project quality plan provides the backbone to the effective management of the project. It is an essential tool for project managers and design managers.

In line with all good project information the quality plan should be a concise and precise document. Lengthy project quality plans will not be read, until something goes wrong, by which time it is too late. It is also important to review the project quality plan at regular intervals to ensure that the contents are still relevant to the project goal. The quality plan will need to be agreed upon and signed off by the client prior to the start of the project and when changes are required to the document. In addition to the basic project information the project quality plan will include items such as:

- Names and contact information for the project participants and their organizations
- Clearly stated project goals (linked to the strategic brief)
- Communication protocols (extent of meetings, use of intranets, etc.)

- Clearly defined roles and responsibilities of each organization (e.g. the design consultants and where appropriate specialist subcontractors and trades with a design input)
- Extent of constructors' design input
- Protocol for information production and exchange (usually linked to specific software and interoperability requirements)
- Master program with clearly defined control gates for the delivery and approval of design work, which is usually linked to the design program and the construction program
- Change control procedure
- Agreed protocol for dealing with conflict and disputes
- Performance measurement protocols
- Procedures for capturing knowledge (defined learning events in relation to the master project program)
- The name of the person(s) responsible for checking that the project is running in accordance with the project quality plan.

Design team assembly

IT IS NOT UNCOMMON for design and construction teams to form in an ad hoc manner. An initial contact leads to other organizations joining, and before we know where we are, the project is underway. In these cases it is more by luck than judgement if the participants get along and are able to work in an effective manner. It is worth taking the time to carefully select the members of the design (and construct) teams. This is best done once the strategic brief is complete and the project goal established. Ideally it should be done when the client has approved the project brief and the project quality plan. It is then possible to select the most appropriate organizations and individuals to develop the design. Depending on the procurement route it may also be possible and desirable to select the main constructor and specialist subcontractors. Their early involvement can contribute invaluable knowledge to the design process, resulting in a more efficient build process and more accurate time and cost estimation.

Organizations and participants should be selected based on their knowledge and skills *and* their ability to work effectively as a team. This tends to imply that previous knowledge of individuals is necessary in helping to assemble a team that is relatively harmonious and targeted at the same goal.

Start-up meetings and workshops

These are used primarily as a means of allowing project participants to meet and get to know one another prior to any work commencing. The primary aim is to explore the values of the individuals and their organizations to reach some form of understanding. This can be expressed by a shared set of project values that determine how the project team is going to communicate and collaborate towards the common goal. The aim is to explore and agree on a set of common values for the project. This underpins the working relationships within the temporary project coalition and is particularly important for projects based on trust, such as partnering and other relational forms of contracting. Someone who has no stake in the project usually facilitates these types of workshops. His or her role is to encourage open communication and effective interaction. Facilitated workshops are a useful tool to:

- Identify how best to work together
- Agree on a common language
- Identify and embrace differences
- Discuss and agree on a conflict resolution strategy
- Make promises (and keep them)
- Identify interfaces, the exchanges of information and resources
- Manage interfaces to enable the flow of information and resources.

Rules of engagement

Do not tell people how to work; it rarely works out as intended. It is much better to get the main stakeholders together to discuss how they would like to work and identify differences as early as possible. This needs to be done on two levels (as a minimum): first, with the senior members of the organizations involved; second, with the people who are actually going to do the work – the designers and engineers, design managers, consultants, and subcontractors. This will help to bring about an integrated design team. Given the long duration of construction projects these workshops may need to be repeated several times to revisit the rules of engagement and bring new contributors into the project ethos.

The design manager and design team structure

Clients will want to communicate with only one organization, and preferably one individual. They desire single-point responsibility. This contact is usually

the lead designer or the design manager within the design team. Sometimes this contact is direct; sometimes it is indirect via the client's project manager. Given the importance of clear communication routes it is necessary to agree who the main client contact is, and express this in the form of a relationship diagram. Communication routes with the main design consultants, such as the structural and mechanical engineers and cost consultant, can also be included to produce a design team structure. This diagram can then be added to the project quality plan for reference and guidance.

The design program

THE DESIGN PROGRAM must be coordinated with the overall project program. In all but the most simple of projects the project manager will be responsible for agreeing to the project program with the main participants. The two main subsets of this are the design program and the construction program. Responsibility for the design program will be that of the design manager. Good design management is founded on a clear and realistic program of design activities.

The design program will include the key stages in the project, ranging from briefing through concept design and detail design to concluding with the start of the construction phase. Time will also need to be allocated to the construction phase to deal with requests for information and proposed design changes. As with all programs, simplicity is key. It is of little use providing a highly complex program of activities in a software package that the rest of the team struggles to read and understand.

The project manager will devise the master program. This will set out the start and end dates, key milestones and target dates for the completion of certain stages. The design program needs to honor these key dates so that packages of design information are provided at the agreed date. In addition to this the design program will define key dates for the design team to achieve. These dates are exclusively for the design team to achieve, and the production of work in accordance with the dates needs to be monitored and managed by the design manager. A highly effective means of planning projects is to use collaborative planning techniques. This is a relatively simple process that relies on individuals making promises about what they will deliver and when (see also Chapter 8).

Typical dates will relate to these major events and will, most likely, be linked to a familiar process plan, such as those offered by the AIA and RIBA:

- Completion and approval of the project brief
- Design team assembly and appointment
- Completion of the concept design and cost plan
- Submission of drawings for permits to build and environmental compliance
- Completion of detailed design and updated cost plan
- Completion of contract information.

Within these dates space needs to be allowed for design iteration. A highly detailed program may be self-defeating since it will suffocate creativity. One of the skills that design managers need to master is the balance between just enough control and the space for creativity. Too much control is stifling, whereas too much freedom is chaotic. Control gates for formal design review and client approval of the design are recommended at major stages in the program.

Programs should allow 'float' – that is time to deal with unknown challenges. Programs should also include 'buffers' between design packages with a high level of interdependency. A buffer is time between the completion of one package of work and commencement of another. The buffer allows the space for a slight overrun in the completion of the first package of work without impacting on the commencement of the next work package.

Design dependency and responsibility

IT IS VITAL that all designers understand what they are expected to produce and when. Although this is outlined in the project quality plan it is common for design managers to produce a matrix of design responsibilities. This will help to identify the interfaces between the various designers and establish the level of design dependency. It will also help with the planning of the design program.

Design dependency is a term used to describe a situation in which one designer is reliant on another to progress their work. In the majority of design

projects we are all dependent, to lesser or greater degrees, on other designers to be able to progress our work. An obvious example would be an architect being unable to progress the design drawings because the structural engineer has not provided the column spacing for the structure. Design managers need to be able to map the design process and identify who is dependent on whom, and what the impact may be on the design program.

Design responsibility matrix

A design responsibility matrix is a tool for helping to establish responsibility and degrees of dependency. This will help to identify potential challenges before they arise. Once they are known it is possible to put procedures into place to manage the dependency. This may be as simple as making an adjustment to the design program to allow more time for a specific design dependency to be resolved. In other situations the mere fact of highlighting the dependency is enough for the designers involved to address it as part of their work routine. The challenges arise when design dependencies are not fully understood or not identified at the outset of the project. This will, inevitably, lead to delays and in the worst cases conflict between the parties involved.

Design checklists

A design checklist is a schedule of drawings and associated design information that needs to be produced for a project. Agreeing what needs to be done, and when it is required, will be instrumental in helping to manage the design process. The design checklist will help to inform the production of the design program. As the design proceeds the design manager can use the design checklist to monitor progress against the program.

Design cost plan

AT THE BRIEFING STAGE the client will have set out the project budget, and the design team will need to design to that budget. The design manager's role is to encourage the design team to derive maximum design value for the given budget. This will be achieved by working closely with the cost consultants and the design team. The client will expect relatively accurate cost

estimates at agreed intervals in the design process. The agreed intervals are usually at the end of a work stage, or in very large projects at specific intervals within work stages. As the design develops and becomes more detailed, and the uncertain aspects start to be resolved, the cost estimation will become increasingly more accurate.

The design manager needs to monitor the development of the design to ensure that the budget is not exceeded. If it is, then the design will need to be adjusted to ensure that it is in line with the client's expectations. Working closely with the cost consultant and/or with computer software to track the cost of the design is a challenging and essential part of the design process. Being able to bring product manufacturers and specialist trade contractors into the design process as early as possible will also help with the accuracy of the cost plan. Other ways of ensuring that the costs are meaningful are to use historic cost data from recently completed (similar) projects. In situations where the design includes some unique and innovative elements – for example a new façade system – it will be essential to bring the manufacturers of the façade system into the discussions concerning detailed design and cost. As a general rule, the closer the design team is to the producers, the more accurate the cost estimates.

Clients do not like surprises, especially when it comes to cost. An important aspect of the design manager's job is to be able to present the design and the associated cost information without causing upset. In situations where the design is running over cost it is important to alert the client prior to formally presenting the cost plan and explain the reasons for the overrun and the strategy for getting it back on track. Being able to generate regular cost updates will help to prevent big surprises.

Life-cycle costs

Historically the cost plan dealt with only the cost of the construction. More recently the cost plans have become more sophisticated to reflect the entire life-cycle cost of the project. The life-cycle costs include the cost of construction, the cost of operation during the building's service life and the cost of disassembly and materials recovery. Focusing on life-cycle costs not only enables the design team to make decisions that reduce the running cost of the building (sometimes involving slightly higher initial costs) but also concentrates the mind to the building's end of life and the cost of disassembly.

Monitoring the brief as the design develops

ONE OF THE CHALLENGES for the design team is to stay within the scope of the project brief. During the design phase the design team will be encouraged to test the brief via their design proposals, often leading to new insights and knowledge, and hence the need to update the project brief to reflect the evolving nature of the project. The design manager must put in place a procedure that allows the designers the space to explore a number of creative options and suggest revisions to the brief as appropriate to the development of the design. It is also necessary to provide the client with an opportunity to respond to the suggested changes to the project brief. A variety of tools are used to monitor (track), check and approve changes to the project brief at the design phase as well as during construction. In the design stage this is often discussed at progress meetings, design reviews, value management and value engineering exercises and at control gates. In the construction phase the process is formal, as changes to the brief will constitute a deviation from the contract.

Design (change) control

CHANGE CONTROL PROCEDURES are most pertinent at the construction stage when deviation from the approved design will have implications for the program, the cost and the quality of the building. This is explored further in Chapter 3. At the design stage it is important to allow space for exploring options and preferences; thus design change control has a different meaning to later in the project. The challenge for design managers is to decide how best to keep track of the changes in line with previously agreed parameters of time, cost and quality. In situations where it is necessary to depart from the parameters set out in the project brief it will be necessary to discuss the implications with the client and get the changes approved. A number of established tools can assist with monitoring the development of the design; the most common are as follows:

- **Design critiques**

  These tend to be informal events held in the design office. In this forum the design can be reviewed by the design team against the project parameters, but in the private confines of the office.

- **Design reviews**

  Regular reviews are required as part of the overall design program. These are usually linked to some form of control gate and attended by the main project participants, including the client. The intention is to review the design and approve it, or parts of it, prior to proceeding to the next activity. The parameters for the review include the project brief, statutory consents, budget, program and design quality.

Design progress reports

KEEPING ALL PROJECT participants and the client informed of progress is one way of helping to manage expectations and avoid uncertainty. The frequency of reporting should be commensurate with the scale and complexity of the project. Ideally the reports should be presented at progress meetings so that there is the opportunity to respond to questions raised by the report. Reports should be concise and written in plain English. Although the style varies considerably across organizations, the chosen format should be consistent for individual projects. Typical items to report are:

- Status of drawing production. This should be reported as actual progress compared to planned progress. Simple visual tools, such as traffic lights and smiley (or not) faces, are extremely effective. An example would be complete (green light), incomplete (amber light) and not started (red light). A more detailed way of reporting is to use percentage complete – for example 100%, 50%, 0%.
- Status of the design. This may relate to changes requested by the client or changes brought about by outside parties – for example to meet the requirements of the town planners.
- Status of the design team. This can relate to the (under-) performance of organizations and individuals. It can also be used to report challenges that have arisen due to illness and individuals moving jobs, which tends to influence design dependency and thus put pressure on the design program.
- Status of the overall design program. This needs to be reported against previously approved key dates for the design program and, where appropriate, the master program. Progress may be ahead of or behind that initially planned.

- Status of the build costs and life-cycle cost estimates. Costs need to be reported against agreed targets so that decisions can be taken to keep the design within cost parameters.

Coordinating and agreeing on the design prior to construction

Software technologies allow designers to work in a collaborative environment in real time, and clashes within the drawings can be highlighted as they occur. Although software, such as BIM technologies, is not foolproof (rubbish in = rubbish out) it is a major development in the quest to improve the quality and the coherence of design information. The coordination of the various design and engineering inputs to the digital model will save considerable time and effort when coordinating information on the construction site. Indeed, it is the developments in computer software that are helping to drive the design manager from the construction site to preconstruction activities, where the most value can be added.

All production information must be reviewed by the design management team and approved (signed off) prior to issuing it to the constructors. This is a time-consuming activity, and appropriate time should be allocated within the design program.

Vignette – design management at the preconstruction phase

Ben Bourke
Design Manager, Preconstruction, Carillion Projects, UK

From my point of view design management during the preconstruction phase is vital to the success of a project. I consider myself lucky coming from an architectural background. This allows me to know the construction process throughout but ultimately to know what the consultants need, why they need it and when. I can spot when consultants have not put enough information into their design documents, which makes it difficult to provide accurate prices. I also know when the consultants are trying to hide behind a performance specification and hoping that someone else – that is the constructor – will sort it out for them. Picking up early on these issues and resolving them prior to construction save the constructor considerable time and effort and help to provide increased certainty with costs and program.

At Carillion the design manager and the project manager manage the preconstruction process jointly. Account managers are also involved on large projects and for large clients, but the day-to-day running of a project is the responsibility of the design manager and the project manager. All design, governance, regulations and environmental compliance (e.g. BREEAM) is controlled by the design manager, who then calls on the estimators and cost consultants (quantity surveyors) for cost plans and legal requirements.

All elements of the design will be the design manager's responsibility, and therefore all aspects of design (architectural, structural, mechanical and electrical services, etc.) must be understood fully. Because design managers generally have a good design background, projects can run smoothly. However, if a design manager is not appointed early within the project, the design is not managed correctly and the project manager may not always understand or appreciate the consequences of design actions. This can happen when a new project comes straight through from the commercial team and with a strong desire to get the project onto site as quickly as possible.

I find the majority of problems arise from projects being rushed through without the early involvement of design managers. Ultimately, early involvement will benefit design managers, contractors and clients. Often clients do not fully know what they want, so it would be a design manager's role to fully develop the brief with them prior to the commencement of design.

In conclusion, I would say the key to success for any project is good planning and management from the start. A design manager can concentrate on design development and delivery, while the project manager (and others) can concentrate on their responsibilities, such as delivering the project on time and to budget. This helps to avoid overloading individuals with tasks that lie outside their remit and contributes to a smoothly running project.

Tips for success

- Involve the design managers at the earliest opportunity
- Take a good brief from the client and challenge the brief if needed
- Listen to your consultants and let them do their job
- Take the consultants' advice on aspects of the design that are not your main area of knowledge (which in my case is M&E)
- Be upfront with the client regarding design changes and the implications these have on program, cost and quality. A good change control procedure should help with this.

chapter 3

Construction – delivering design value

ONCE VALUE HAS BEEN EXPLORED and codified into the design information, the next stage is for constructors to translate the information into a physical artifact. It is at this stage where there is a major shift in culture, moving from a highly creative phase into a more pragmatic one. Here the construction design manager's task is to deliver design value to the client while also satisfying the commercial goals of the constructor. This is done primarily by coordinating and managing design information for compliance with the client brief, contract documentation and regulations. Incomplete or missing information is requested via requests for information (RFIs) and proposed changes to the design are managed via a design change protocol. This means that the construction design manager will form a bridge between the design team and the constructor's delivery team. Most construction design managers will report to the construction project manager and work alongside the site-based construction manager(s).

Construction design managers occupy a difficult position, on the one hand protecting design integrity and on the other making changes to help the constructor realize the project safely and within agreed project parameters without compromising design quality. At this phase the construction design manager needs to consider how design information is best translated into a physical artifact. The strategic decisions will relate to information flow and exchanges, and the operational decisions will relate primarily to compliance and change control. The strategic decisions will help to minimize the number of operational decisions. To be effective the construction design manager will need to understand the designers' and the constructors' perspectives. It is the design manager's job to oversee coordination of design information and design quality. It is not the design manager's job to design; any challenges with the design or design information needs to be referred back to the design team.

From design to construction

THERE IS A SIGNIFICANT change in culture when the project starts to be realized. Designers give way to the constructors and the design value codified in drawings and specifications is translated into a physical artifact. The success of the construction phase will be dependent upon many factors, some of which can be controlled and some of which cannot (e.g. the weather and the economic fortunes of a nation). The important factors are as follows:

- Accurate information that is fully coordinated. Without this we are into the realms of guesswork, uncertainty and risk.
- The ability of the construction team to interpret and, where appropriate, challenge the design information to improve, for example, constructability. This relies on the construction team's design literacy.
- The ability of the construction team to interact effectively with the design team. The bridge between the design culture and the construction culture can be made via the preconstruction and construction design managers. It is the design managers who have an understanding of both worlds.

At the construction stage the design team's work should be complete, or substantially complete. Thus involvement of the design team will be restricted to dealing with requests for information, addressing design changes and attending progress meetings in accordance with the contract conditions. In fast-track projects where the design and construction activities are compressed and overlapped there is likely to be a greater degree of interaction and involvement of the design team at the construction stage. Similarly, in projects where there is a substantial amount of specialist design input from the trades and subcontractors there will be interaction between the preconstruction and construction design managers.

We should celebrate and embrace the differences in culture and expertise that exist between the design team and the construction team. Too often this is seen as a challenge and invariably used as an excuse for poor project performance. The differences need to be recognized, discussed and if necessary addressed before the physical work starts. Workshops and meetings are useful tools in helping individuals to better understand one another.

Handover meeting

It is essential to hold a precontract meeting prior to the commencement of the build. The main emphasis of this meeting is to review the project information with the aim of identifying any areas of uncertainty on behalf of the construction team. In many cases this may be the first time that the design team and the construction team have met, and thus it also serves as a mechanism by which the design team and the construction team can get to understand each another. Although the individuals involved tend to be the senior managers, the handover meeting provides an opportunity to review, discuss and understand some crucial elements of the design – namely:

- Explain the design philosophy. This may be very difficult to comprehend from the drawings and project information. It is crucial that the design philosophy be discussed and understood by those managing the construction phase *before* the physical work commences. This will help to ensure that design value is respected and delivered.
- Discuss the most important points of the brief and highlight parameters that cannot be changed under any circumstances.
- Revisit the project quality plan and update to include the new participants and organizations.
- Review the design program against the construction program and discuss any potential challenges (see ahead).
- Discuss the design responsibility matrix.
- Agree on a protocol for dealing with requests for information.
- Agree on a protocol for design change control.
- Discuss compliance with codes, town planning legislation, health, safety and well-being and environmental compliance.
- Discuss and agree on the rules of engagement. How is the design team going to work with the construct team? What happens when it goes wrong? Who is the point of contact, the design manager(s) or the project manager(s)?

The design program revisited

THE CONSTRUCTION PROGRAM, along with method statements for safe working, identifies the main construction activities and the dates for their completion. This is often broken down into key phases, such as completion

of the ground work, the substructure, the superstructure, external envelope, internal works and finishes. This allows the construction project manager to monitor progress against that plan, as well as to coordinate the large number of trades and subcontractor work packages. The construction program also helps the construction design manager to identify what information is required and when.

Responsibility for producing the design program lies with the lead designer and/or the (preconstruction) design manager. It is the construction design manager's responsibility to interrogate the design program to ensure the proposed flow of design information complies with the proposed construction program. Any concerns should be referred back to the lead designer or preconstruction design manager for clarification before any adjustments are made to the program.

Design progress reports

Design progress reports at the construction phase are primarily concerned with monitoring the construction against the approved design. The construction design manager usually compiles these. The aim is to highlight specific issues with the design documentation and the progress of the construction in relation to design quality. Typical reports would provide an overview of:

- Outstanding requests for design information and design changes
- Issues likely to affect statutory and legislative approvals, including environmental compliance and health and safety
- Design quality as realized
- Design issues likely to affect build costs.

Design responsibility matrix revisited

THE CONTRACTOR'S DESIGN responsibility matrix will be a similar format to that used by the design team. However, at the construction phase the organizations and individuals involved will have changed and their remit will have shifted from generating design value to delivering design value. However, under many contractual arrangements there will still be

a considerable amount of specialist design to complete. Relationships will need to be revisited and established and responsibilities reviewed and redefined. Subcontractors and specialist trades may have responsibility for designing certain packages of work – for example the façade. Their interdependencies with other subcontractors and the main contractor will need to be mapped within the design responsibility matrix. These activities are linked to the production, coordination and approval of design information. This will need to be managed by the construction design manager, interacting with the contractor's project manager and the preconstruction design manager (be they in-house or not).

The design responsibility matrix will enable the construction design manager to identify the relationship between outstanding work packages – for example the design engineering of the façade with other work packages. This will highlight the dependencies on other information that may or may not be complete. This intelligence will inform the construction program.

Design reviews

CONSTRUCTORS WILL REVIEW the design prior to construction to ensure that the information provided by the design team can be translated into a physical artifact. The constructor's main priority is to program work packages so that the building can be assembled in a logical, safe and cost-effective manner. The design review forms part of the constructor's design verification process.

The purpose of the design review is to review the information provided by the design team to check that it is complete and capable of being transformed into a physical product. This allows the constructor to establish that the design information has been supplied in accordance with the specification before it is issued to those who need it. Construction design managers will undertake the review, usually in partnership with the construction manager. This should be conducted before the project commences and subsequently at regular intervals to review newly issued design information. Design reviews also allow project stakeholders to contribute to the process and hence have their opinions considered. They function at their best with a small group of experienced professionals reviewing

the information as a group exercise. What one may miss another may see, given their different knowledge and experience. Design reviews are conducted to:

- Review the content and quality of the information against the project quality plan, brief and specification.
- Coordinate the design information provided by a wide range of design consultants, specialist trades and subcontractors.
- Check the design information for environmental and legislative compliance.
- Examine the information for constructability.
- Identify risk and potential challenges for the construction team, to be explored separately – for example via a value engineering exercise.

Reviewing specialist trades and subcontractor design

Design information packages produced by specialist trades, and subcontractors will need to be reviewed for compliance in a similar manner to that described earlier. The difference is that the specialist design information is generated from the information provided by the design team. If the base design information is erroneous, then it follows that these errors will be repeated in the specialist design packages. This helps to emphasize the importance of checking the main design information before it is issued to the specialists.

Specialists are likely to raise a number of questions about the base design information, which may result in RFIs being issued to the design team before the specialist design work can proceed. This tends to be less of a problem if the specialists are consulted during the precontract phase, which is not always feasible or desirable.

Sign-off is required for the specialist subcontractor drawings. This needs to be carried out by the construction design manager by carefully checking the coordination of drawings with the base design information. This will result in the drawings being approved for fabrication or returned to the specialist for further work.

Value engineering the design

Value engineering (VE) is often used when the cost estimates are higher than the project budget to help identify aspects of the design specification that can

be changed to save initial build costs. Using VE purely as a cost reduction exercise is to undermine the value that a well-managed VE exercise can bring to the design and construction teams.

At its best, VE is a tool used to examine aspects of the design specification and, where appropriate, propose alternative solutions. The VE exercise needs to be facilitated and must include the appropriate specialists within the workshop. Value engineering is best conducted at the design stage, although it is more common to use the technique postcontract, usually when there is an issue about the cost of a particular feature. Given the interdependent nature of much of the building components and elements, it is likely that changes to a specific issue may well impact on neighboring components and possibly the overall performance of the building. This is why it is important that the appropriate specialists are contributing to the workshop so that the decisions made are considerate of the overall building design. The alternative proposed will need to be put through a change control process.

Design information checklists

IN AN IDEAL WORLD information should be complete and fully coordinated. We know that this is rarely the case. Reviewing the design production information will help to identify areas of the design that need further work and highlight aspects of the information that are incomplete, incorrect, uncoordinated or unclear to the constructor. As previously noted, the adoption of BIM technologies and associated software can significantly reduce the number of design clashes and assist with the coordination of information. However, this does not mean that the information is error-free, nor does it mean that those reading the information and translating the codified information into a physical product can understand what was intended. The construction design manager acts as a filter between the design team and the delivery team, reviewing the information and ensuring it is complete and understandable prior to releasing it for construction.

Creating a design information checklist allows the construction design manager to oversee all of the project information requirements. The design manager will have a comprehensive overview of the entire project information package. Other members of the team will be interested only in the

package of information that directly affects their work. The design information checklist will help to highlight the following:

- Information that is complete and fully coordinated. This can be issued to those who need it.
- Information that is incomplete and/or uncoordinated. This will be returned to the design team with a request for it to be completed within a given timescale (usually stipulated in the contract and the project quality plan).
- Missing information. This will trigger a request for information (discussed ahead).
- Design dependencies.
- Design program issues.

Dates can then be allocated for the completion of the incomplete and missing information to coincide with the constructor's main design program. As discussed in the previous chapter this involves understanding information flow and appreciating how long designers require to finalize (or revisit) specific packages of information. Time also needs to be allocated for checking and coordinating the new information once received by the contractor; there is no guarantee that it is complete until it has been checked and coordinated.

Managing requests for information

Requests for information (RFIs) are necessary to address missing or incomplete design information. Poorly conceived and coordinated design information will generate a large number of RFIs. A large number of RFIs is an indicator of a poorly managed design team and is linked to overruns on project cost and program. There is usually a correlation between a large number of RFIs and poor design quality.

An RFI indicates uncertainty and risk. It is only when the information is received that the full extent of the required work can be clarified and the risk eliminated. This allows the construction design manager, the project manager and the cost consultant to understand exactly what is required. This allows definitive costs and time to be associated with the information. In doing so it mitigates the uncertainty and associated risk.

RFIs are usually issued by the construction design manager via the design team's design manager (or lead designer). The contract will stipulate

how long the design team has to respond with a full set of information. Given the complex interaction of design components it is rare for designers to be able to issue the requested information quickly as many issues have to be checked for interdependency and potential clashes.

Design change control

AT THE CONSTRUCTION STAGE it is important to monitor all proposed changes against the client brief, the approved design information (and project quality plan) and regulatory approvals (building permits and environmental compliance). Changes will impact the project cost and the project program and the quality of the building. As a general rule of thumb, the further into the overall program, the greater the impact of the change on cost, time and quality. Thus the fewer the changes at the construction stage, the more likely the project will be delivered on time, on budget and to agreed quality parameters.

Changes to the approved design may arise for a variety of reasons, relating to the following:

- Availability of materials and components
- Constructability issues
- Cost concerns
- Program overruns.

Changes to the design often involve a whole host of interrelated issues, with, for example, a simple change affecting the overall performance of the building. It is essential that all proposed changes are carefully assessed for their impact on the building as a whole and their effect on existing building consents and permits and associated environmental compliance. The construction design manager is ideally placed to do this, having a complete overview of the design and design dependencies.

Design change protocol

A variety of tools are used to manage design changes, the main components being in line with standard design change protocols. Contracting organizations tend to have their own versions of change control tools to suit their

specific market sector. At their heart lies a simple procedure that should include the following steps:

1 Refer all proposed deviations from the contract information to the lead designer and/or the preconstruction design manager. The request for the change should be accompanied by a reasoned argument for the change and the implications in terms of program, cost and quality. Without this information it is impossible to make an informed judgement on the effect of the change.
2 Once the change has been evaluated it can be rejected or put to the client for approval. Await agreement (or otherwise) prior to proceeding with the change. Ensure all decisions are recorded in writing, making sure to confirm any verbal decisions in writing at the earliest possible opportunity.
3 Revise drawings and associated design information to reflect the change.
4 Revise the design program and project cost as appropriate.
5 Update the project brief to accommodate the approved change or include a note within the project brief as to why a specific item cannot be changed. This is particularly important on projects with a long timescale to stop the request being repeated at a future date.
6 Review the reasons for proposed changes on a regular basis as part of a planned learning process. If similar requests arise from one project to the next, it tends to imply that there is a problem somewhere in the design phase. Identify the root cause of the problem and mitigate it.

Charging for additional design work

Design changes will have an impact on the design team. Time is required to assess the proposed change and if approved it is inevitable that the design information will need to be revised and reissued. This has resource and cost implications for the designers. Someone has to pay for the time and the client needs to be made aware of the resources required to make changes and the associated costs.

If allowance has not already been made in the appointments of the design team (e.g. changes to be charged on an agreed hourly rate) it will be necessary to cost each change and agree on the fee to be charged before the change is implemented. In a fast-moving project environment this is unrealistic. Thus it is essential that a protocol for dealing with design changes, and

associated schedule of charges, is agreed on at appointment and is included in the project quality plan. The client must be kept informed of the changes and the associated initial and life-cycle costs.

Managing cost variations

COST CONTROL CONTINUES to be a major concern for clients at the construction stage. In the majority of contracts the project cost will have been agreed to prior to commencement of the construction work. Invariably this figure has a tendency to increase as the project progresses. Although the design manager is rarely directly responsible for controlling project costs, many of the actions taken by the construction design manager will have a bearing on the cost of the project. From a design management perspective the main reasons for cost variations are as follows:

- Incomplete design information when the contract was signed. Although constructors will allow for the uncertainty it is difficult to estimate costs from incomplete information. The more complete the information, the less the tendency for the initial cost to change. Thus the aim of the design managers, both preconstruction and construction, is to keep requests for information to a minimum. The higher the number of requests for information, the higher the uncertainty and thus the higher the chance of the project cost changing. In new build projects there should be no excuses for incomplete information. For work to existing buildings the challenge is different, and it is often impossible to have all information in hand until the building is opened up and analyzed.
- Requests for changes. Changes at the construction stage will affect the project cost, in either a positive or a negative manner. As already noted, the reasons behind the request for changes to the design are numerous. While some may be impossible to predict at the design stage – for example unforeseen problems with the ground conditions – the majority of the requests for change can be mitigated by providing complete information and applying a robust change management tool.
- Innovativeness of the design proposal. The more creative and unusual the design, the higher the risk and uncertainty. Estimation of project

costs becomes more challenging with unusual and innovative design proposals. In such situations it is highly likely that the cost estimate is incorrect and some form of value engineering will be required to try to keep the costs in check during the construction phase.

Project completion and reviewing performance

COMPLETION OF THE PROJECT should be a cause for celebration – a job well done and a satisfied client. Unfortunately, it is not always a success and lessons must be taken into new projects to reduce the possibility of the same mistakes being repeated. Once a project has been handed over to the owner there is an opportunity to reflect on project performance and review the value delivered. It is also a good time for learning, as discussed in Chapter 4.

Measuring performance

A number of performance measures may be used to determine how the project team performed. The merits of one over another need to be reviewed in the context of the organization conducting the performance review. For example, the focus of the engineers may be different to that of the architects and hence the performance measures may differ. Performance measurement is about an attitude to continual improvement. It is not just about metrics.

Organizational performance

- Were the project objectives met? This can be measured against the project quality plan, brief, specification and program.
- Did the project return a profit on the resources invested or did it return a loss? This is measured by analysis of the resources committed (mainly time) and the income received.
- Were the staff satisfied with the overall project performance? This is best measured via a satisfaction survey and/or interviews with the individuals who worked on the project.
- Did the project add intangible value to the organization? This is difficult to measure, but tracked through acquisition of new clients and projects.

Project performance

- Were the client's values realized in the finished building? This will be measured against the final version of the project brief and specification.
- Were the participants satisfied with the performance of the project team? Given the number of project stakeholders this is best measured via an online satisfaction survey.
- Did the project team perform as expected, or were there conflict and disputes? This can be measured by the number of recorded disputes and conflict recorded in the minutes of progress meetings.
- Was the project delivered safely? This is measured by the number of recorded accidents on site.
- Was the project delivered to agreed quality standards? This is measured against the final version of the project specification, and against the number of defects recorded at practical completion.
- Did the design managers add value to the process? This is difficult to measure, but can be compared with similar projects in terms of number of RFIs and design change requests.

Individual performance

- Did the individuals enjoy their role? Were they comfortable or stressed when carrying out their duties?
- Did they achieve individual and team performance goals?
- What would they do differently next time?

Monitoring the asset in use

Staying in touch with the client and learning about how the building performs in use is essential if we are to learn from the way the building performs. This is sometimes a relatively informal interaction between the owners of the architectural and engineering firms and the building owner. However, if we are to learn from the building we need to invest in recognized ways of measuring the performance of the building.

Postoccupancy evaluation (POE) is an established way of reviewing the occupied building to see how it is performing. Typical issues to review are energy use, maintenance costs and use of internal spaces and facilities. This is usually assessed against the project brief (hence the need to keep the brief up to date). For clients with a large building portfolio and repeat clients there

will be a clear link between their asset (facilities) managers and the procurement of new building projects. Data gleaned from POE can be used to inform the specification of new similar building projects.

Vignette – reflections of a consultant design manager

John Eynon
OpenWater Consulting, UK

I am often asked how I ended up in design management. It was a fluke! Or maybe the universe was conspiring to get me in the right place. It was the end of an economic recession in the 1990s; I had been made redundant a few times and needed to get back into the mainstream construction industry. An ex-colleague from an architect's practice asked me if I wanted to be a design manager for a major contractor. I said yes and that decision changed the course of my career.

I had always enjoyed being involved on site and working with contractors, including a year on site as a resident architect. So although I thought I was prepared to an extent for what followed, it was quite a different story. In hindsight it took me about 12 months to adjust to life in a contracting environment because there was so much to take on board and assimilate. First, being involved directly in the construction process is quite different to working in an architectural practice. One is immediately involved in the procurement and construction process, right at the coalface, so the pressures are more intense compared to architectural practice. I think it is fair to say that the majority of architectural practices are insulated to a degree from the site process in terms of understanding and knowledge of the contracting environment. Second, it takes a while to adjust to these processes and the different roles involved. Getting a project through the tendering process and on to the construction site is a real team effort, involving many specialists and often working to extremely pressurized deadlines. However, this also presents opportunities to learn and broaden one's experience, and you do learn a huge amount every day. In gaining this experience I have developed a growing admiration for project directors and project managers as they shoulder the full and final responsibility for the

delivery of their projects. Also gaining an understanding of how buildings get built from the codified information provided by the design team is a real eye-opener. I tend to think of it more as a military operation, with command lines, logistics and organization, making sure everything arrives on time and fits safely into place.

Over the last 20 years I have worked on varied projects, such as offices, arts centers, schools, colleges, prisons and housing, up to about £100 million in project value with some of the UK's leading architects and designers. The role of the design manager brings one into contact with all kinds of people who are involved in the project, from the client to the designers, specialists and many others. This makes it a challenging yet rewarding role.

Many years ago I started out on a journey to become an architect, and I believed that one day I would have my own architectural practice. On reflection that was a rather traditional and limited view. As my career has evolved into design management it has opened up a much larger and broader world to me. I have gained an appreciation of the total project process and the stakeholders and personalities who play their part. I have worked with some amazing people on great projects. I have, of course, also had my share of mistakes and disasters. And one is never too old to learn, from the good and the not so good experiences.

Tips for success

If you are thinking of moving into design management there are a few tips and hints that will help:

1. Whatever your background (design, construction, surveying, etc.), find out about the areas you do not know about. Get a placement or secondment and talk to people in different roles and with different backgrounds.
2. When you are in the role as a design manager take time to understand the quality assurance and design management procedures of your organization. There will be guides, tools and policies that you will need to comply with and use; combined these also help you to get the job done.
3. Understand the roles and agendas of everyone you interface with in order to do your role successfully. Understand what they need from you and why; understanding what they do and why they do what they do will help in this regard.

4 Understand how your activity fits into the whole project process. The role of the design manager enables one to learn so much more and you may discover the pathway for your next career move.

5 Keep up to date with developments in the construction industry, including everything to do with BIM and how that affects your role.

6 Reach out to other design managers across the industry. Join forums, link with others across organizations and read books and articles on design management. It is good to talk, and you will most likely discover that others are dealing with similar challenges to you. You can catch up with me at www.zenanddm.com.

7 And finally, early in my career as a design manager I thought that there was some magic ingredient to success, a 'silver bullet' perhaps. Looking back on my career I do not think there is. It is simply good management: understanding the process, roles and activities that combine to make a successful project. Good luck!

chapter 4

Working together – valuing design interactions

NOW THAT WE HAVE ADDRESSED the value creation and value delivery phases of projects, attention turns to how we interact effectively within temporary project environments. Design managers need to be able to build, maintain and develop relationships with designers and constructors. They need the skills to hold honest and open conversations with fellow project participants to enable maximum value to be created and delivered. This is about people trusting the design manager and the design manager behaving in a consistent and professional manner to earn that trust. This is particularly important when projects start to go wrong; people start to behave differently, more senior people become involved, behavior becomes defensive and it is too easy to drift into a blame culture, which is counterproductive. It follows that the design manager must give attention to how people behave in a challenging project environment. Learning to value interactions will be instrumental in helping to deliver design value to the building sponsor, users and society.

Collaborative working

PEOPLE WORKING TOGETHER towards a common goal make projects successful, not processes. At the heart of all design and construction projects lies the way in which individuals for a wide variety of professional and commercial backgrounds come together during the life of the project. Relying entirely on (standard) process plans and contracts will rarely bring about a harmonious, creative and successful project. Attention must be given to how project participants interact, with a view to maximizing their collective skills and knowledge. This means that design managers must understand how designers and constructors behave in temporary project environments.

4.1 Working together: addressing communication, trust and conflict in project teams

Collaborative working is founded on the principle of shared values and common ethics. This should underpin the use of collaborative design environments (CDE) using digital (BIM) platforms and integrated project delivery. Effective interaction of project participants is determined in part by the procurement route and contract conditions, and in part by the manner in which the project is managed and how people behave. There is a strong argument for relational (nonadversarial) contracting, although these presently constitute a very small proportion of the total number of contracts awarded. Partnering and lean and integrated project delivery all provide a more collaborative and trusting approach to the delivery of projects compared to more traditional approaches, which too often result in adversarial relationships.

The challenge is to put a design and delivery team together who can work together in a productive manner. This means addressing communication, trust and conflict within temporary project teams (Figure 4.1).

People and behaviors

Projects comprise a multitude of organizations and professionals. Each organization has its own organizational culture, history, values, ethics and corporate

goals. Similarly, the individuals representing each organization work within the ethics, culture, values and traditions of their profession or trade. They will also hold personal goals, which may or may not be compatible with their employer and/or project goals. This makes for an exciting and potentially explosive mix within a temporary project environment when (divergent) cultures are brought together. Understanding who is contributing what and when will help to identify the interfaces where tension is likely to be highest (see ahead). Understanding the personalities and motivations of individuals will help the design manager to anticipate behaviors. This is discussed in more detail in Chapter 5.

It is unlikely that the design manager will know the personality of an individual early in the life of a project, but understanding different personality types will help design managers to spot certain behaviors. There are a small number of established personality indicators, and while managers are not expected to be expert social psychologists, an understanding of the underlying personality traits can be helpful. It is also useful to understand one's own personality type, and a number of online tools can assist in giving a quick indication. One of the best known is Myers-Briggs.

The Myers-Briggs Type Indicator is based on an individual's basic preferences from the four dichotomies implicit in Carl Jung's theory. These are:

- **Favorite world**. Do you prefer to focus on your own inner world (introversion – I) or the outer world (extraversion – E)?
- **Information**. Do you prefer to interpret information and add meaning (intuition – N) or do you prefer to focus on the basic information (sensing – S)?
- **Decisions**. Do you prefer to look at the people and the circumstances surrounding the decision (feeling – F) or do you prefer to first consider logic and consistency (thinking – T)?
- **Structure**. Do you prefer to stay open to new information when dealing with the outside world (perceiving – P) or do you prefer to get things done (judging – J)?

By answering a series of questions about preferences (usually via an online tool), it is possible to get an indication of one's own personality type. This allows us to understand the differences between people and embrace those differences to maximize the performance of a team. There is no one best

personality type; all types are equal and complementary. Thus when assembling a team it would be useful to have a mix of personality types to ensure a balanced team. The problem facing managers is that we rarely have such information on hand. Myers-Briggs gives an indication of personality type; it does not measure ability, trait or character. That is best determined through interaction with others. (See myersbriggs.org for further detail.)

How do we establish effective communication?

COMMUNICATION IS AN ESSENTIAL aspect of human interaction and a fundamental factor in the effective management of projects. A common project language, or at least a simplified language free from acronyms and technical terminology, will help to encourage participation and prevent individuals from feeling excluded from discussions. The means of communication – the formal communication routes and means of information exchange – must be discussed, agreed on and confirmed within the project quality plan. Similarly, the data exchange formats will need to be discussed, agreed on and confirmed in the BIM execution plan. Running alongside the agreed means of communication are individuals' preferences for certain communication media, such as:

- Face-to-face dialogue
- Telephone
- Email
- Video conferencing
- Meetings and workshops (physical and virtual)
- Project extranet systems
- Project BIMs.

When problems arise, individuals tend to use informal communication channels in an attempt to resolve the issue. Although this may be useful in diffusing tensions and resolving issues quickly, there is unlikely to be a record of the communication. Simple communication and reporting structures will help, but design managers should be aware of individuals' idiosyncrasies and expect a little deviation from the agreed communication protocols.

Language

Communication is a social activity, the sharing of information and the sharing of experiences. This is dependent upon the communicators understanding the rules of communication for a specific project context. Professionals and tradespeople have developed specialist languages, using words and terminology that are specific to their discipline: essentially a unique vocabulary. This enables members of the same discipline to communicate facts and ideas quickly and efficiently. The other side to this is that those outside the discipline may find it difficult to understand the meaning.

In multidisciplinary temporary project organization, it is inevitable that the participants use language in a variety of ways and hence speak a different language to their fellow participants. Mechanisms must be put in place to allow the participants to understand each other (e.g. workshops and social events).

How do we develop trust?

TRUST UNDERPINS ALL business relationships and is related to the distribution of resources, power and money. Trust allows organizations to share commercially sensitive information and engage with other organizations in a project environment. The design manager's remit is to build trust within the design team, *and* develop trust with the constructors. Building trust with the design team is concerned with guiding and steering the designers to specific project milestones for the delivery of design information at the correct quality. Trust will be earned from the constructors by providing design information on time, to the agreed quality and in a fully coordinated manner.

Trust is a firm belief in the reliability of a person or a thing, an attitude held by the truster towards the trustee. The perceived level of trustworthiness will come from interaction and communication with others and experience of the way they act and behave. The implication here is that we need to have some experience (either direct or indirect) of a person or an organization before we can start to trust them. The opposite of trust is (managerial) control. Business relationships are often based on low levels of trust and a certain amount of distrust, which is why we have legally binding contracts

that set out the rules of engagement. There is nothing wrong with this type of relationship *per se*; indeed, one could argue that everyone knows where he or she stands when there is little or no trust between the parties. Rules of engagement are known at the start of the contract and there are procedures to mitigate the lack of trust. At both ends of the scale, total trust or total distrust, we know where we stand. Unfortunately such absolutes are rare in practice and because trust is contextually derived the space between trust and distrust is often obscured. Thus working relationships are difficult without establishing some clear parameters.

Limits and boundaries

We trust some people more than we do others, and we trust them with different aspects of work. Within the organization there is regular interaction between staff and the degree and levels of trust are usually well understood; indeed many professional offices rely on trust and mutual respect in preference to rules and regulations to achieve their objectives. By contrast, management by trust is not easy to achieve in a project context. With people interacting only occasionally and holding different organizational values and objectives, the development of trust is far more challenging because participants often have very limited opportunities to get to know others well enough to develop an adequate level of trust.

- Within organizations trust will be developed over time as relatively stable relationships are developed within small groups and subgroups of employees. Individuals will know how people behave and how they respond to certain circumstances. Internal meetings and social events can help to nurture trust within the organization.
- Within the project environment relationships are less stable compared to an organization. Individuals enter and leave projects at various junctures, making it very difficult to form regular patterns of interaction. Interactions are infrequent and it may be difficult for individuals to develop trust unless some specific interventions are designed into programs to help develop and maintain trust. Examples are 'teambuilding' workshops prior to the commencement of the project and prior to the beginning of major phases – for example from briefing to design, design to construction.

How do we manage conflict?

PARTICIPANTS SHOULD BE WORKING towards decisions made by consensus, which calls for tact, diplomacy and the ability to negotiate. This does not mean that we need to agree with everyone all the time, as this is not conducive to successful projects. Design managers need to build a project culture in which the participants feel comfortable challenging and questioning others, with a view to creating the best possible design value for the client. Sometimes it may be necessary to 'agree to disagree' so that the project can proceed and not be stifled by indecision.

There are two types of conflict, constructive (positive) and destructive (negative). Constructive conflict occurs naturally as individuals disagree or challenge their colleagues. The intention is to improve the outcome of the discussion. Destructive conflict occurs when an individual deliberately sets out to undermine a discussion and create tension. The intention is to gain an advantage (financial or otherwise) from the unnatural conflict. The challenge is to minimize destructive conflict and encourage constructive conflict. This means getting the team selection correct at an early stage in the project.

When things go wrong

When things do not proceed as planned it is essential that the design manager acts swiftly to get the project back on track. The procedure is to:

- Stick to the facts
- Keep emotions out of the debate
- Aim to identify the root cause of the problem before taking action
- Stick to the agreed project protocol for dealing with conflict
- Learn from the experience (and share that learning with colleagues).

Tools: identifying and managing interfaces

AN ESSENTIAL SKILL for managers is to be able to identify the main interfaces within projects so that they can be managed to maximize effective interaction. This is an area of projects that is far too often left to chance, the view being that there is a program and associated process plan(s) in place so everything

will be okay. It will not. Interfaces need to be mapped and managed to deliver successful projects. Interface management is a term to denote the task of managing interdependent organizations and individuals to achieve a common goal. The focus for the design manager is the interaction of designers and the interaction of the design team with the construction team.

How do we identify interfaces?

Interfaces between construction materials form physical boundaries or joints, which are relatively easy to design and manipulate to achieve the required technical performance for a building because they can be seen. Interfaces between project organizations form softer boundaries that are determined by legal contracts (which specify responsibilities), but that are often blurred as individuals work informally with others at the margins of the boundaries.

Organizational and cultural boundaries within construction projects are constantly changing; individuals enter at certain stages, and the team changes in size and format. Boundaries of responsibility and interests in the project are constantly in a state of flux. Obvious boundaries are the interfaces between client and brief taker, brief taker and design team, design team and contractor, contractor and subcontractors. Other more subtle boundaries, for example between architects and engineers, also exist.

There are two fundamental types of interfaces with projects:

- Organizational interfaces

  Organizational interfaces are mainly defined by contracts and the project context. Interorganizational relationships are concerned with organizational culture and the interoperability of management and ICT systems. Although the relationships can be dynamic, they are relatively straightforward to define, map and manage through the life of the project.

- Personal interfaces

  Individuals interface with others representing other organizations, not the organization *per se*; thus interfaces are colored by the ability to communicate and work with representatives of other organizations. Effectiveness of the relationships is dependent on compatibility of the individuals concerned. These interfaces are challenging to define, map and manage. Over the course of a project individuals may be allocated to different projects; thus new individuals join the project and new interfaces are created.

These interfaces need to be managed. Some of the main areas to consider are as follows:

- Interface definition. Map primary and secondary interfaces and identify areas of uncertainty.
- Responsibilities. Clearly defined and visible areas of responsibility can help to reduce disagreements and disputes.
- Communication. Clear and effective communication is central to interface management.

Tools such as a design decision matrix can be used to help identify interdependency, and hence some of the important interfaces. This has to be considered in the context of the program and will need to be revisited at regular intervals to reflect the changing nature of the interfaces.

Tools: meetings and workshops

MEETINGS AND WORKSHOPS are where we get the opportunity to interact face-to-face and test the trust we hold in other project participants. Formal meetings and events will form part of the project plan, although it may be necessary to hold impromptu meetings to address unforeseen events. Meetings and workshops can be classified as one of two types, either 'internal' or 'external' to the organization. This can have a significant bearing on how individuals behave and communicate.

- Internal (closed) meetings and workshops are limited to participation by the organization's members only. In a familiar environment it is possible for the participants to be relatively informal, open and trusting of the other members. Discussions tend to be relatively open with shared objectives. An example of this type of interaction could be a number of designers discussing the design development of a particular project within their office.
- External (open) meetings and workshops include the presence of participants from other, possibly competing, organizations. In this environment individuals may act in a more formal manner, be less candid and less trusting of the other members' motives (regardless of procurement route). Discussions tend to be relatively guarded and objectives might not be shared.

Productivity of meetings and workshops is an important consideration. Both consume a considerable amount of the participants' time in preparing, traveling and attending (and subsequently responding to agreed actions). They should be used sparingly and be integral to the project's strategic process plan. The value added to the project is the ability to encourage interaction and candid discussions. Although a variety of metrics could be used to measure the efficacy of meetings and workshops, the main concern for managers should be with the process (effectiveness of group processes and communication), the product (quality of the outcome/solution) and perception (how the participants perceive the process and the product).

The function of meetings

Meetings are convened to deal with procedural issues and are primarily concerned with the achievement of tasks. Interaction is mainly task-based, although they also serve to develop relationships. Meetings are used to:

- Appraise. Appraise progress and the performance of projects, organizations and individuals.
- Bond. Meetings fulfil a fundamental human need to communicate and bond, and hence help foster team relationships. Meetings can also be used as a tool to help motivate the project team, although this function may be better served through facilitated workshops.
- Control. Meetings allow managers to stay aware of progress and in command of the tasks to be completed. They also allow those attending to follow up information requests, allocate resources, agree on action and set deadlines. All decisions should be recorded in the meeting minutes.
- Coordinate. Face-to-face discussion may help with the coordination of works packages and the clarification of roles and responsibilities. The aim is to ensure that adequate resources are allocated to allow operations to take place effectively and safely.
- Develop trust. Addressing tasks and resolving problems in a meeting forum can help to develop trust.
- Explore possibilities and preferences – for example through structured client briefing exercises.
- Resolve and clarify. A timely meeting can help to resolve problems, differences of opinion, minor conflicts and disputes.

Meetings can also be classified by type, as shown in Table 4.1.

Table 4.1 Types of meetings

- **Design progress meetings**
  The primary aim of a design progress meeting is to review progress against the design program. It is good practice to include the client (or the client's project manager) in design progress meetings. This helps to keep the client updated with progress and allows the client to participate in discussions relating to design value.
- **Design team meetings (and workshops)**
  Design team meetings should be conducted in an atmosphere of trust and complete openness. The intention is to identify areas of the design that can be improved and also areas that may be problematic. Design team meetings should address progress of the design in accordance with the brief and highlight areas of the design to improve. Issues relating to coordination of design packages may also become pertinent, although they are usually best considered in a separate forum to ensure that the focus of all participants is on design quality and getting the best possible design value for the given parameters.
- **Coordination meetings**
  Given the importance of coordinating design information from a wide variety of sources it may be prudent in large and complex projects to hold coordination meetings as a separate event to design team meetings and progress meetings. Although software developments in BIM facilitate coordination and clash detection it is still important to review and discuss coordination to ensure that the information put into the BIM model is both correct and sufficiently detailed. The focus of the participants should be on how the separate design packages come together. Attention needs to be given to the flow of design information as well as the accuracy and quality of the information.
- **Review meetings**
  Reviewing the performance of the project and the project participants is an important function. This helps to identify how the project performed against the parameters set out at the start of the project.
- **Knowledge exchange meetings (learning)**
  It is essential that we learn from the project and the completed artifact as it is used over time. Bringing people together to explore what they learned and how best to disseminate and apply that experience to future projects is preferable to relying on individual recall (see ahead).

The function of workshops

Workshops differ from meetings in that they are concerned with establishing and developing interpersonal relationships, either as a primary or secondary function of the workshop. Interaction is mainly socio-emotional. Development of relationships is often achieved by working collaboratively towards solving a (nonproject-specific) task (e.g. a simulated role-play exercise or an educational game) or by working collaboratively on a project-specific issue – for example

in a value management (or value engineering) workshop. Workshops provide a forum for creative interaction and have a central position in collaborative design approaches and the development of integrated temporary project organizations. In addition to helping to establish group membership and social identity in a temporary organizational setting, workshops are also used to:

- Build trust
- Confront groupthink
- Create knowledge
- Develop working relationships
- Establish project parameters
- Explore different perspectives (and disagreements)
- Resolve conflict.

Workshops can be classified by type, as shown in Table 4.2.

Table 4.2 Types of workshops

- **Collaborative planning**
  Collaborative planning techniques have been around for a while, and are commonly associated with lean construction. The principle is that all contributors to the project discuss and agree to a program of work in a workshop setting. The outcome is a set of promises made by those responsible for delivering specific packages of work. The result is usually a much more accurate representation of the program than if dictated by a project manager. An approach to collaborative planning is described from a constructor's perspective in Chapter 8.
- **Creative problem solving**
  There are occasions when a design problem seems to be unsolvable. In such situations it may be necessary to hold a workshop that involves project participants and invited experts to discuss and try to resolve the design challenge. This is sometimes referred to as a creative cluster workshop, where the goal is to reach a creative solution.
- **Value management and value engineering**
  Value management and value engineering are usually workshop-driven events, where the emphasis is on collective decision making.
- **Team building**
  Workshops have a role to play in helping to build and maintain project teams. They need to be scheduled into the overall project program, with particular attention paid to the start-up of key stages. Similarly, used at the delivery of a key stage they can be a useful vehicle for individuals to reflect and share their learning experiences.

Tools: learning events

SIMILAR TO THE NEED to identify interfaces within projects is the need to identify where learning events would be best positioned within the life cycle of the project. Individuals will be learning as the project develops, and it is important that this knowledge is captured and made available for use on future projects. Incorporating feedback (as part of the process plan) is an essential feature of successful projects. The challenge for individuals and organizations is to integrate the learning opportunities into the normal working week – that is making learning part of a balanced program of work. This can be achieved through the following:

- Experiential learning from projects and the product
- Reflection on work
- Learning from how others approach their tasks
- Learning from books and articles via evidence-based learning
- Learning in action via action learning
- Learning through storytelling.

Levels of learning

Evaluation and learning take place on three levels, at the individual, organization and project level:

- Individual needs

  Self-evaluation and learning is fundamental to being a professional. Engaging in reflective practice and undertaking formal (re)training courses will enhance our knowledge and help to develop new skills. Self-development may also be enhanced through applied research projects. An individual's learning will be colored by his or her employing organization and the projects on which the individual is deployed (see also Chapter 5).

- Organizational needs

  Organizational development will rely on a combination of individual self-development and formally organized group staff development. Investment in employee development schemes can help an organization to stay competitive and responsive to changing markets.

- Project needs

  Learning from a project can be conducted during the life of the project and after the project has been completed. Learning events need to be incorporated within the overall project program, ideally at the completion of each major phase. Used sparingly, knowledge exchange meetings can form a platform for participants to share their knowledge with others.

Vignette – the design manager's challenge of coordinating and liaising with multiple internal and external project stakeholders

Lanre Gbolade
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The design management role takes shape in many forms dependent on the type and size of organization the individual works in. Having worked in the construction industry, both in architectural practice and in client developer organizations for a number of years, I have gained insight into the design manager role from both sides of the table. I am currently working with one of the UK's leading residential developers in the role of design management and coordination, but my experiences have been shaped through working on a wide range of projects in the residential, health care, retail and commercial sectors, both in the UK and internationally. This has given me an excellent understanding of the positive impacts of collaborative design management. It has also fueled my passion for fostering project team collaboration and using advanced information technology systems to develop efficiently designed and constructed buildings.

The developer client has many functions but typically one main goal: to deliver a profitable product, usually in the form of a physical building asset. This asset will be developed for sale (disposal upon completion); it may be held and leased; or it may be maintained in a complete design/build/operate arrangement. The roles I have undertaken in the function of design management for residential developers include

technical coordinator, assistant design manager and design manager. Each suggests different roles by title alone, but in reality they are very much centered on the same tasks and goals, although with increasing responsibility, direct reporting, accountability and authority. Experiences gained from working in organizations within a design/build/operate and design/build/sell arrangement form the basis of much of my personal observations that follow.

My continually developing approach to design management is shaped not only through practical experience but also by observing team leaders, professionals and colleagues and through academic study and research over 13 years. I have come to appreciate that design management is a dynamic and very worthwhile role in the construction industry. It allows those involved to appreciate the multitude of complex issues that need to be considered throughout the development process. From my practical experience, some of the key tasks of a design manager (preconstruction) include the following:

- Formulating and appointing a design team, ensuring the right consultants are engaged at the most appropriate time.
- Communicating the employer's requirements (ERs), the standards and specifications, to those appointed to provide the design, engineering, construction and related services.
- Chairing and leading design team meetings towards successful delivery of the ERs.
- Assessing, reviewing and interrogating design information in line with the ERs.
- Coordinating the delivery of design information in a timely manner from multiple consultants and supply chain contractors, while managing internal department communication.
- Being commercially aware of the impact of design change and being able to gauge the financial and program implications of project risks.
- Managing project risks and ensuring those responsible for design work consider the risks associated all the way through the project life cycle (design, construction, maintenance and disposal).
- Promote an environment of collaborative working that challenges the status quo and leads to value-adding (optimum) design solutions.

- Keeping abreast of design and technical standards, including changes to regulations and codes to ensure optimum value is achieved over the duration of a project.
- Managing and keeping track of inevitable design changes, all in line with cost plans, overall development program, city planning, building control and statutory approvals.

All of these tasks require the design manager to be, or become, adept at managing a multitude of (sometimes conflicting) issues, each with their own level of importance in relation to cost, quality and time. The outputs of all or most of these tasks will have an impact on various internal organization and external stakeholders. While an organization will have an overarching goal(s), each of these internal stakeholders will have their own goals and motivations, and naturally, they will be of most importance to the individual requesting information. For example, a large-scale residential developer organization will have a number of functions within it, ranging from land to planning, design, technical, build, surveying, commercial, sales, customer services, asset management, aftercare and estate management. The external stakeholder list is equally long and includes local planning authorities, building control bodies, clients, statutory authorities, consultants, supply chain partners and a host of other stakeholders who are not directly involved in the development process but who are interested in the decisions being made and how the decisions may impact them.

Marrying the incompatible motivations of these varying functions and stakeholders can be a challenging task, but an essential one for the design manager. The reason is not definitive, but a fine-tuning of collaborative working methods is a theme that consistently springs to mind when this issue is raised. While the idea of collaborative working is not a new concept, as architects and master builders have had to use this method of working since time immemorial, the challenges of delivering built assets in an increasingly commercially driven market sector do raise the stakes. My practical experience has highlighted that one of the key components of collaborative working is effective communication. I have found the following techniques to be effective and productive:

- It is always worthwhile bringing the keys issues to the table with the right personnel and the most appropriate communication medium.

This will help with the discussions and will assist the decision-making process.

- Personnel management is a key part of the design management role, helping to create strong working relationships. Fostering a good team spirit through effective (timely and open) communication helps to achieve effective working relationships.
- Be prompt and accountable for the delivery of all promises made. If the promises are not achieved it is essential that the design manager is transparent about the reasons with those expecting the information. A pragmatic proposal for resolving the issue in a timely manner will also be expected.
- Use a variety of methods and techniques to effectively communicate technical and design information to organizational personnel who work primarily in nontechnical design roles and the wide range of external stakeholders.
- Find a middle (acceptable) ground for multiple parties that helps to satisfy their goals and motivations. It is not always an easy task, but using effective communication to negotiate towards this end is the goal.

It is my belief that design managers can add value to the process of building design and construction through efficient, collaborative design coordination, information management and value engineering (in the truest sense of the term, not only through money-saving exercises). The design management role is broad and requires a skillset to match, including the following:

- Being proactive
- Being responsive and not shying away from responsibility
- Appreciating that one does not need to know the solution to every issue or challenge but being able to steer the team towards exploring opportunities to problems, and hence provide informed solutions
- Being able to recall a personal memory of experiences that do not often repeat themselves in order to resolve a challenge; experience is key to undertaking the role effectively
- Sharing experiences with other team members and being aware of every opportunity to develop knowledge and capture successes and the lessons learned for incorporation into future projects

- Appreciation of the professional work of others and how the various members of the project team can contribute to design managers' successes
- Keeping the bigger picture in mind and understanding the placement of a specific project in the context of the organizational strategic goals/targets

chapter 5

The design manager

THE DESIGN MANAGEMENT role has been around since the 1960s, first being developed in the architectural profession, but rarely adopted. By the late 1980s and early 1990s the role started to be taken up by the more progressive contracting organizations, primarily in the UK, but also in Brazil and Scandinavia. The role has rapidly evolved to cover the entire range of design and construction activities. This chapter provides an insight into what a design manager does, with three vignettes from design management professionals helping to illustrate the richness of the role.

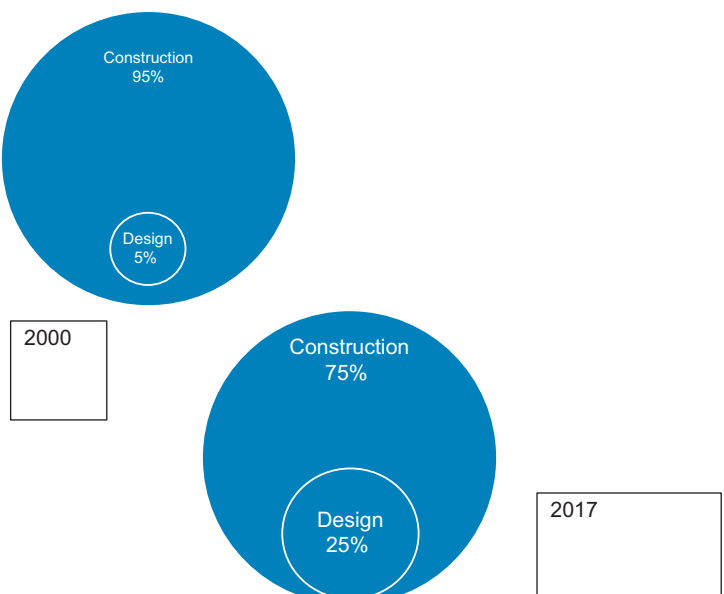
Design management roles

INITIALLY THE CONSTRUCTION DESIGN management role was concerned with checking and coordinating design information provided to the constructor by the design team. Design managers were based on the construction site for the majority of the working week, interacting with the construction project manager(s) and the contracts managers. In the early years design managers often referred to themselves as a 'post box' where all design information was sent to be sorted, checked and coordinated, prior to being issued to the workers on the construction site. Since these pioneering days many countries have witnessed a significant increase in the number of design managers employed by contracting organizations, ranging from Australia to Europe and South America. Taking a snapshot of the construction design manager role in the UK in 2000 and in 2016 helps to show how much the role has evolved in the contracting sector.

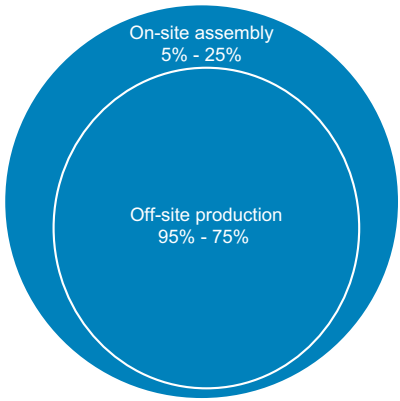
In 2000 the number of design managers employed by constructors was relatively modest but growing. The (construction) design managers were located on the construction site, working alongside project managers

and construction managers. Their role was to resolve challenges relating to the coordination of design information, manage requests for information (RFIs) and manage design changes, primarily to improve constructability and address cost/program challenges. Ten years later constructors started to realize that many of the issues being dealt with by their construction design managers should have been addressed much earlier. Their response has been to move the design manager role upstream into the preconstruction stage, thus helping to further improve efficiency during construction. This has resulted in two job functions, the preconstruction (or precontract) design manager and the construction design manager.

At the time of writing this book it is now generally accepted that the design management role should be approximately 75% preconstruction and 25% construction. If working entirely with off-site fabrication the function would be nearer 95% pre-assembly and 5% at the site assembly stage (see Figures 5.1a and 5.1b).



5.1a Evolution of the design management role from construction to design



The future?
Design managers controlling value prior to production and assembly

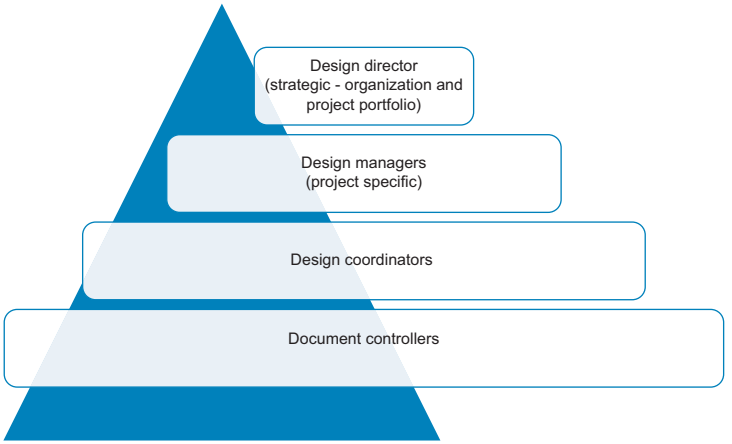
5.1b Evolution of the design management role from construction to design: the future?

Readers should ask where they currently are and where they wish to be in the future.

The majority of contracting organizations have a career structure for design managers, which helps to differentiate different roles, functions, tasks and actions. This usually takes the form of a hierarchy (see Figure 5.2), and progression from the bottom to the top will depend as much on experiential learning, desire and ability as it will on qualifications. Typical job titles start at document controller and progress to design coordinator, design manager and finally design director.

Document controller

This is often the entry level into a design management career, with individuals coming off the tools – for example from carpentry and plumbing – to go into a management career. Aspiring design managers learn about design management and, in some cases, start to appreciate how the business is managed. The focus is individual projects and the control of project documentation. The document controller is an essential and complementary function to that of design management. When individuals have developed an appropriate



5.2 Typical design management hierarchy

level of understanding of document control they may then progress to a design coordination role. Typical responsibilities include the following:

- Ensuring design information compliance with city planning and building permits
- Checking design information for errors and omissions
- Assisting the design coordinator.

Design coordinator

As the term implies, design coordinators are tasked with coordinating a wide range of design information at the project level. The entry route is via success in a document control role or entering with an undergraduate degree in design management or a design-related program, such as architecture or architectural engineering. The design coordinator will work alongside and under direction of the design manager. The design coordination role will usually extend to dealing with environmental and legal approvals. Typical responsibilities include the following:

- Coordinating and issuing design information
- Liaising with design team members
- Assisting the design manager.

Design manager

Design managers are usually tasked with managing people and processes, primarily at the project level but also forming a link to the organization's project portfolio and business objectives. An important skill will be the ability to work across institutional and disciplinary boundaries. Individuals will usually have qualifications (or experience) equivalent to full membership of a relevant professional body. At this level people skills and leadership need to be demonstrated alongside sensitivity to commercial demands. Typical responsibilities include the following:

- Leading the project design team
- Ensuring project targets are met
- Liaising with project stakeholders.

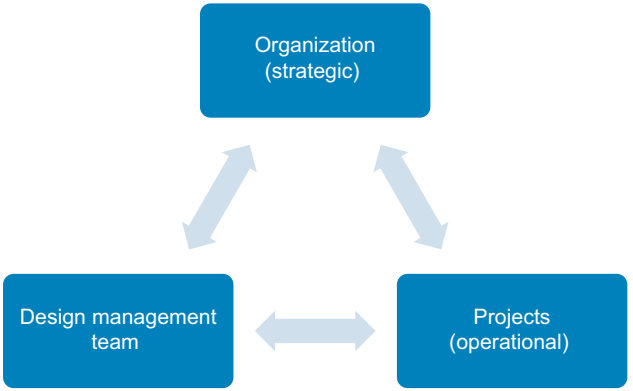
Design director

The design director, or senior design manager, will work across multiple projects at a strategic level. The emphasis will be on setting goals for the organization and individual projects. He or she will form an important interface between the organization's business objectives and the organization's project portfolio. This position demands excellent leadership skills, people skills and commercial management skills. Competences in these areas are developed and honed over a period of many years, enhanced with training, education and targeted reading. Typical responsibilities include the following:

- Setting commercial and quality targets for the design portfolio
- Managing design staff and allocating staff to projects
- Monitoring performance of staff and projects.

Establishing the design manager's remit

THE DESIGN MANAGER'S REMIT will vary across organizations, projects and countries. Despite this, there are some generic considerations applying to all situations. These relate to responsibilities at the organizational level and the individual project level (Figure 5.3).



5.3 The design manager as bridge between strategic and operational decision making

- **At the organizational level – strategic remit**

  Businesses are never static, constantly adjusting to the changing marketplace for services. Organizations must offer a consistent level of service to their clients and therefore the way in which design managers operate across the organization needs to be consistent, a point taken up later in this chapter. Design managers must be able to manage individual projects in line with the strategic commercial aims of their employer. This means that operational decisions taken at a project level must be done while cogent of the organization's business objectives.

- **At the project level – operational remit**

  It is essential that the design manager's remit is discussed and agreed on prior to the commencement of individual projects. It is also necessary to review the design manager's remit at regular intervals to ensure it is still relevant, which is especially important on projects with a long duration, where the tendency for change is more prevalent.

Design manager responsibilities

There are some typical (generic) responsibilities that apply to construction design managers, regardless of who they are employed by or at what stage of a project they specialize in. Design managers are primarily responsible for

ensuring design quality is realized within the constraints of time, budget and resources. This can be broken down to include typical tasks:

- Achieving design quality targets
- Arranging, coordinating, attending and chairing design team meetings and workshops
- Collaborating with a wide range of project stakeholders and other departments to develop and realize the design
- Complying with codes and regulations – for example health and safety legislation and managing environmental compliance (e.g. LEED, BREEAM)
- Conducting design reviews and design appraisals
- Delegating and reviewing design team tasks
- Ensuring design parameters are adhered to
- Guiding and leading the design team
- Integrating the design
- Meeting client (and stakeholder) expectations
- Motivating a wide range of designers
- Presenting design proposals
- Reporting on progress of design tasks and packages
- Reviewing budgets and financial reporting
- Setting design quality targets (in consultation with the client)
- Value engineering the design.

Vignette – design integration

Susan Snaddon
Associate Director, Planning and Development, Arup, Johannesburg, South Africa

I studied building in South Africa and had my first jobs in Johannesburg with Bovis (in an on-site capacity) and a small firm of project managers. I learned very quickly that the whole of a project has to work, bringing together all designers and stakeholders, for the benefit of designers, financiers, contractors and ultimately the building users. I moved to the UK in 1999, initially working in project management and space planning, before taking my first

formal design management role at GallifordTry in Uxbridge. I really loved the action-focused space of herding a team of creative designers and specialist subcontractors all towards a common goal with a fixed time frame in mind. I returned to Johannesburg in 2006 and started working for Arup. I was hired on the basis of my design management experience, particularly to ensure that the range of engineering disciplines on any given project is properly synchronized and offers a coherent service.

I prefer to term the work I do design integration because I find that designers perform poorly when 'managed' in the traditional sense. But the designers do need to be integrated for projects to succeed. I am not strong on systems and programs, but I think the biggest challenge and opportunity is getting diverse, multilingual people to understand each other, particularly when they are spread remotely (which inevitably happens on our projects in Africa). This is why I focus on clear communications – for example prioritizing workshops and capturing design meeting resolutions in visual, accessible ways rather than standard minutes. An example of what I do is taken from an urban planning project.

The planning meetings tended to have upwards of 20 attendees; some were experienced designers and others were laypeople from the client body. Within these meetings we often had presentations from different work streams (e.g. urban design, transport, infrastructure). Sometimes after the formal meeting there would also be a walkabout around the urban area. I would ensure the agenda was very clear and achievable within the time frame. Record keeping is a critical element of design projects and minutes are the accepted means of recording meetings. To try to make the minutes user-friendly and readable, I took photographs during the meeting of the physical marked-up sketches being presented by the urban designers and a few photographs of the meeting discussions themselves. I also made sure I received soft copies of any PowerPoint presentations made during the meeting. I kept the minutes as brief as possible, keeping the notes to what was discussed and any decisions reached, and noted any actions and associated dates. I interspersed the notes with images under the relevant sections. These have several benefits:

- It is obvious who attended because there are photos of them in the room;
- Minutes are easier to read as they have visual reminders of the content that was discussed in the meeting;

- The key sketches/presentation images are part of the minutes so the decisions made are very clear. This is more effective than cross referencing a difficult-to-locate sketch in some online repository;
- Photographs of the site visit were added at the end of the minutes, including relevant notes of any key constraints discovered/opportunities to be exploited.

Tips for success

My tips for success in design integration relate primarily to communication:

- Be precise in your language when you write and speak;
- Ask questions and listen well;
- Encourage all team members to ask questions. It is especially important to cultivate a safe place for juniors to ask questions, as they often ask brilliant ones;
- Draw out those team members who are introverts, and ensure others do not 'hold court' inappropriately;
- Pay attention to what people are saying and what they are not saying;
- Be inclusive;
- Use collaboration websites only for drawings, specifications, and so forth, *not* for communication;
- Learn to touch-type;
- Be wary of using cloud-based BIM models if some of your team have poor bandwidth;
- Always consider designs from the user's perspective;
- Be gracious with genuine mistakes. Cultivate a nonadversarial, supportive culture;
- Make an effort to understand and appreciate the design aspirations and cultures of places in which you work. Do not impose your preferences;
- Make use of sustainability and universal access as unifying topics to get designers thinking about the overall product rather than their specific discipline;
- Keep abreast of current thinking in a wide range of topics – design, technical, economic, environmental and so forth;
- Use technology appropriately (e.g. MS OneNote is quite good for minting with words, pictures, spreadsheets all in one place).

Knowledge and skills

INDIVIDUALS MOVING INTO DESIGN management positions tend to come from quite a wide background, ranging from architecture and engineering to surveying and the trades. Although individual knowledge, skills and competences will vary according to background and personality, there are some fundamental requirements necessary to do the job.

Knowledge

Regardless of one's individual background, a design manager must possess comprehensive knowledge of how the design and construction process works. This includes a working knowledge of building technologies, health and safety legislation, environmental legislation and life-cycle costs. He or she also needs to appreciate how the various 'designers' and 'constructors' who make up the project team like to work and communicate. While some of this knowledge can be taught in universities and acquired from self-study, there is no substitute for learning on the job. Experiential learning comes from the practical application of design management to live projects, which, combined with self-reflection, will inform and shape design managers.

Skills

Although many of the skills required are similar to those required of project managers, there is a deliberate bias towards design knowledge and a deep understanding of the design process. Design managers must be able to champion and defend design quality. In addition to having a passion for design quality, design managers must also demonstrate excellent communication skills. They will need to have empathy with designers and constructors in addition to excellent interpersonal skills. This will help them to navigate the uncertain waters that lie between the various project stakeholders and the design and construction cultures. This requires 'people' skills, such as tact and diplomacy, negotiating, coordinating, communicating, integrating, organizing and leading. It also demands the determination and drive to achieve goals in a multidisciplinary project environment. It follows that a flexible and agile approach to management is necessary to allow design managers the space to respond to unexpected events and rapidly changing situations. This needs to be balanced by a reassuringly consistent and fair approach to day-to-day

decision making. Individuals will have strengths in different areas, but the following skills are essential:

- Building trust and effective working relationships
- Coordinating diverse design works packages
- Listening to colleagues and project stakeholders
- Promoting and defending design quality at all stages of projects
- Communicating effectively using written, oral and graphic media
- Consistently managing the production and realization of high-quality designs
- Leading the design team
- Motivating and maintaining high standards and commitment within the design team
- Realizing business objectives through effective design management
- Resolving design-related issues and problems in a timely and efficient manner
- Supervising design team members.

Vignette – what motivates design managers?

Robert Toon
Design Manager, Kier Construction, UK

For a design manager, communication and information transfer are of paramount importance for the success of a construction project. Good communication equals good information; good information equals informed decisions; informed decisions equal a good product. Behind all the communication and information transfer that design managers have to deal with are people. People are the major influencers of a project's success, and changes such as the adoption of BIM and the move to off-site production seem, on the surface at least, to be trying to eliminate people from construction. The reason for these changes is, undoubtedly, the error and mistakes associated with human-run projects. Human error amounts to many problems and delays on a construction project, but is taking the person out of the project a positive thing? Is it not the diversity of people whom we work with and the different relationships that form that make the construction industry great?

One of my interests is related to what motivates individuals in construction, and in particular, what motivates design managers. While studying for my BSc in design management I undertook research to see whether there are 'common goals' within the construction industry and, if so, if these can be managed in order to improve project efficiency. I found that the term 'goal orientations' fitted what we do, and this led to my interest in motivational psychology.

I found that the motivations of individuals on construction projects are not solely hedonistic. On entering the construction sector individuals are motivated by the intrinsic needs of enjoyment and interest. When they have worked in the industry for some time these motivations tend to change due to external pressures (e.g. family), which results in their day-to-day motivations becoming hedonistic. I also found that there was very little difference in the perceptions of what motivates individuals from various disciplines, be they an architect, design manager, engineer or constructor. However, the design managers did exhibit some specific differences to their fellow project participants.

The design managers claimed to be motivated by the relationships they developed in the working environment. More specifically they claimed that it was working in a team that really motivated them. These intrinsic motivations become evident as design managers strive to make a difference to their environment, using the relationships to help them achieve their goals of realizing a great building. They want to be in control and change the environment in which they live. Design managers believe that working in a team can make a great difference and this is what truly motivates them.

Design managers also claimed that they tend to manage workers as if the workers are hedonistically motivated (by money). My research found that this form of motivation is not the only form of motivation in the construction industry, and it would be dangerous for design managers to think that others are not motivated by many factors. Having a better understanding of the goal orientations of those we work with will help us to better manage people and in turn achieve better results.

Reflecting on experience from practice it is clear that individuals have different agendas and are motivated in a variety of ways. On a day-to-day basis the design manager will be dealing with many issues and communicating with a large number of people, each from different backgrounds and each

with a different skill set. If one attempted to manage these people by using a formal, set-by-step guide, then it is highly likely that things would get missed and the velocity of the project would leave a design manager trailing in its wake. Undertaking research into motivational factors has added value to what I do as a design manager because I am more prepared and better able to deal with people. I have often thought of my research when managing people, and it definitely helps to think of how the individual you are speaking with is motivated, which in turn allows me to adjust my managerial approach to suit, and hence achieve positive outcomes.

Tips for success

Managing motivations can take many forms, from getting people to do what you know must be done to nurturing the workforce in order to encourage their best efforts. Motivations of individuals should be of paramount importance to design managers. Some tips for success are as follows:

- Get to know your fellow project participants and understand what motivates them.
- People's motivations and goal orientations change. This means that the behavior of individuals may change during the life of a project (or across several projects). Be prepared to manage the situation and stay alert.
- There are no 'common goals' in an absolute sense. On a day-to-day basis there is a wide range of motivations and goals that can be termed as common themes of motivations. These can usually be seen in the way people behave and therefore they can be managed.
- Embrace the value people bring to construction projects.

Ensuring consistency across the organization

ONE OF THE CHALLENGES for large organizations with a large project portfolio is to ensure consistency of approach across the entire portfolio. Individuals will inevitably interpret job roles and responsibilities in a slightly different way to that of their peers. In organizations employing many design managers this can, and often does, lead to differences in approach across the project portfolio. This is especially prevalent where projects are

spread across a large geographical area, states and countries. Despite differences in legislation and local customs (ways of behaving), it is possible to ensure a consistent approach with the organization's regional offices and their projects.

There are a number of ways of achieving consistency, but the most effective is bringing design managers together from across the organization to discuss what they do and why. This helps to share knowledge, identify good practice and also identify the less efficient ways of working. These events can be supported with training and education as part of the individual's personal development plan. A typical approach to ensure consistency would be to do the following:

- Hold an internal knowledge exchange meeting once per year. Invite all design managers and associated professionals, such as commercial directors, project managers and cost consultants, to discuss what they do and why they do it. This will help to identify good practices and areas in need of improvement. It will also help individuals to adopt a consistent approach to design management.
- Create a design manager's handbook that is tailored to how the organization works. This can be referred to by design managers in their day-to-day tasks. The handbook will also be invaluable in helping to induct new members of the organization into how things are done.
- Establish and maintain an intranet knowledge exchange hub. This will allow design managers working across the country or globe to share their knowledge about design management with other members of the organization, whom they may rarely meet. This resource can be systematically reviewed and relevant knowledge incorporated into the organization's design management handbook.
- Establish a strategic review system (annual or biyearly) to review what the design managers are doing in relation to developments in legislation, technology and ways of working. For example, if the majority of the design management activity is currently at the construction phase, consider how this could be moved to the precontract phase and the associated benefits and risks.
- Encourage an organizational culture that rewards openness and knowledge sharing.

Vignette – building design management: working in Sweden

Nicholas Gill
Design Director, Skanska UK plc

In 2012 I was fortunate to be asked to work on the New Karolinska Hospital project in Stockholm. With a construction cost of £1.5 billion, it was Skanska's largest building project at the time and was the biggest hospital under construction in Europe. The contract was managed in a joint venture by Skanska Sweden and Skanska UK, which in practice meant that we followed the Swedish way of working but with the advantage that English was an official language of the project.

At the time I joined the project, work had already started on site and the concrete frame was underway. I was allocated to a small team of building design managers (BDMs) dealing with Phase 5 of the project, which on its own had a £500 million construction cost. The design program was in place, and our objective was set that all design packages had to reach construction status (in Swedish 'Bygghandling') by the end of 2014.

On a day-to-day basis the activities of a BDM on this enormous project were little different from those in a similar project in the UK: managing information flow, answering questions, finding solutions to technical problems, dealing with change and managing the design team. On this project we were using BIM and therefore had BIM specialists as part of our team to assist with coordination, clash detection and visualization. There were also specialist technical design managers who dealt with specific technical aspects of the design, such as mechanical, electrical and plumbing services and facades, and had a key input into our activities.

There were some interesting differences between the Swedish way and working in the UK. First, the Swedish tendency to reach a consensus about everything meant that there were many more and longer meetings than I expected, as all details had to be fully discussed and agreed. Second, there was a high level of discipline built into the design management system: each drawing package was formally issued first for comment, with a two-week consultation period that included meetings to present the design, followed by the opportunity to go through all comments, before formal issue of 'Bygghandling'

information. Each stage of this process was meticulously documented. Fortunately, the time taken for this process was included in the overall design program.

One of the nicer aspects of working in Sweden is the approach to working life. While many Swedes do start work early (many before 07:00), they also like to go home relatively early in the afternoon to make the most of their evenings and home life. Lunch is taken on the dot of 11:30 (which means that no meeting can be organized between 11:30 and 12:30) and is eaten in a separate dining area away from the working area. There is a wonderful Swedish custom called 'fika', which involves having coffee and cakes with colleagues, again away from our desks, usually in the afternoon. These arrangements are in sharp contrast to the English habit of working all hours, coffee on the run and eating sandwiches at our desks while continuing to work. The easy conversation over fika does engender some personal interaction with colleagues that is often absent from work in the UK.

My involvement with the project ended in January 2015, the milestone objective of 'bygghandling' design for Phase 5 having been achieved successfully in December 2014. The project is still under construction, and the main part of the hospital is scheduled for completion in 2017.

My top tips for working in Sweden are as follows:

- Engage in the Swedish approach to consensus in decision making. There is no room for autocracy or loud argument. Individuals who behave like this soon find themselves on the next plane home.
- Understand the meanings of the different stages of design development that apply in Sweden ('systemhandling', 'bygghandling', etc.) and what level of detail applies at each stage.
- Learn a few words of Swedish. In practice, all Swedes speak good English and are quite happy to conduct entire meetings in English for the benefit of one English speaker. But it really does help to be able to say a few words in Swedish.
- Follow the Swedish way of working by taking breaks for lunch and fika with your colleagues.
- Make the most of the opportunity to enjoy the fantastic landscape, vibrant cities and very friendly people in Sweden.

Internal knowledge exchange events

RESPONSIBILITY FOR ORGANIZING and monitoring the effectiveness of internal knowledge exchange events will rest with the senior design manager. These events are linked to consistency and performance.

Training

Training in specific design management tools and techniques, along with specific training in interpersonal skills, is starting to be taken more seriously within organizations. As the design manager role has developed, the need for specific skills training has become more evident and organizations are now starting to deliver and/or procure training for their design managers.

Education

Training alone will not bring about consistency within the organization. Individuals will also need to engage in continuing professional development. This will include attendance at conferences in addition to in-house forums. Reading around the subject and engaging in information exchange networks will also be required.

Self-reflection

The concept of the reflective (and reflexive) practitioner has been known for a long time. This is a powerful tool to help individuals improve how they do their job. Typical techniques include keeping a personal reflective diary (or reflective log) and engaging in organizational events that encourage reflection on daily events. A simple yet effective approach is to do the following:

1 *Describe the event*. Concisely record the event and describe what the challenge was and the individuals and organizations involved. Keep it factual.
2 *Reflect on the event*. Identify how the challenge could be mitigated in the future. What could have been done differently?
3 *Consider action*. Explore some scenarios. How would you respond if faced with the same event in the future? Highlight training and educational needs so that you are better prepared for reading more about the subject.

The reflective diary is a personal document. The aim is to improve individual performance and some of the issues raised may be fed into the annual performance review when discussing future educational and training needs.

Managing expectations

WORKING AT THE INTERFACE of design and construction, the design manager will be tasked with managing the expectations of both constructors and designers, and indirectly the interests of the client. Expectations relate to the effectiveness of the design and delivery process and also the design quality of the completed artifact. Having a robust process plan will help all stakeholders to navigate the life of the project; however, there are some simple rules to follow to ensure expectations are managed:

- Before any work is done meet with the client and stakeholders in a workshop environment to explore exactly what is required, why, when and by whom. This will help the main parties to understand one another and is the first step in exploring and understanding the values of the project stakeholders and establishing trust. Face-to-face discussions will help in developing common (shared) project values.
- Manage the briefing process to ensure that the scope of the work, the business plan (finances) and the program are established before design work commences. Revisit and revise the brief at regular intervals once the design process has commenced.
- Involve the client in all project team meetings. This helps to avoid any surprises.
- Sign off on the design with the client before starting work on site; this will help to reduce uncertainty and unnecessary design changes during construction. It will also help to reduce unnecessary construction waste. Certainty will allow the constructor to schedule the work accurately and will be instrumental in helping the workforce deliver the building on time, on budget and to agreed quality standards.
- Consult with the client on overall design changes, no matter how minor.

- Involve all stakeholders in decision making and ensure relevant information is to hand so that informed decisions are made.
- Keep all designers informed (on a regular basis).
- Never make unrealistic claims or promises that cannot be honored.
- Build learning events into the program. This enables knowledge harvesting and sharing, as well as helping to keep individuals informed.

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chapter 6

Shining light on the dark side: An American architect's journey into design management

Dave Beem
Beem Management, USA

Dave Beem is an architect and the owner of Beem Management, a firm that he recently founded to address his perception of the gaps between the artistic and business content of contemporary architectural practices and current building delivery systems. Educated, licensed and registered in multiple states in the US, his vision for his new company is to "bridge design intent with project reality".

MY WIFE AND I were walking out of the movie theater right after New Year's Eve when we ran into Kurt, a former architectural colleague who had at one time worked at the architectural firm where I had been a partner. After exchanging pleasantries Kurt remarked, "I heard you went over to the dark side." Nice *double entendre*, Kurt. He and his wife had just seen the new *Star Wars* movie, but he was also invoking a phrase often used here in the US to describe an architect who has moved over to join the owner, facilities, management, or construction side of the building delivery equation. In that sense he had heard correctly. I had just left my partnership at the end of 2015 and had opened up my own multifaceted management firm. But his comment begged the question: why would a registered architect with 35 years of experience at an award-winning architectural firm choose to leave that partnership to take such a journey?

The Bucket List
(Warner Bros. Pictures, 2008)

"YOU WANT TO DO . . . *WHAT?*" The reactions of my partners were not surprising. As a collective we had delivered hundreds of successful and highly respected commercial and residential projects, both in the US and in Europe.

As I explained to them, I wanted to explore something different than a traditional architectural practice and instead focus on my passions, which included project management, owner's advisory services, and regulatory entitlement pursuits. Having always been fascinated by the void between the artistic and business content of architecture, I explained that this new venture would allow me to use my leadership skills to work for owners, lawyers, architects, and constructors to bridge that gap. Not only am I wired to think that way, but I had routinely been asked by owners to augment (and even in some cases assume) the lead role of project management (PM) responsibilities for several large-scale projects, even though the owners already had nationally recognized management consultancy firms on board. Having also been exposed to some projects in the UK and to UK-style building delivery systems, I added that I would be pursuing what is known as 'design management', not fully grasping the term or its implications here in the US at the time.

Lost in Translation
(Focus Features, 2003)

IN THE FALL OF 2015 I was still fully committed to my former practice, so my night job became a mission to open up my own shop: to search for space, set up corporate legal status, retain a PR consultant, and prepare for the eventual update of my LinkedIn profile and webpage. Aside from those duties, I spent a lot of time on the Internet trying to understand more about the various players and components involved in the UK building delivery systems, the roles of the Royal Institute of British Architects (RIBA) and the Chartered Institute of Builders (CIOB), and various specialty careers, including those of the quantity surveyors (QS). I already had a working knowledge of broad aspects of this, in part because of the increased and seemingly fashionable requests by informed owners for such services on large-scale projects here in the US. While the American Institute of Architects (AIA) and all of the various construction organizations involved on this side of the pond have tremendous value, my working thesis was that some thoughtful combination of the UK's and the US's respective building construction delivery systems might lead to a fresh and optimized result. Clearly there was a lot of research to be done.

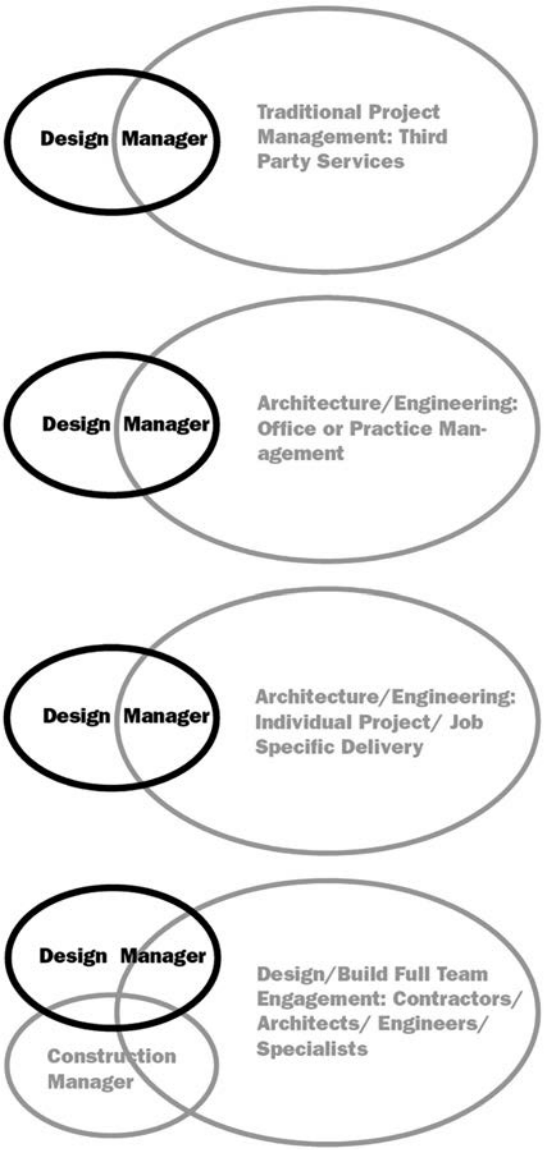
I purchased and studied several books on design management from authors such as Emmitt (*Design Management for Architects*), Emmitt and Ruikar

(*Collaborative Design Management*), and Sinclair (*Leading the Team: An Architect's Guide to Design Management*). As it turns out, all of the authors were primarily UK-based and nothing similar appeared to originate from within the US. That should have been my first clue about the state of design management stateside. In reviewing the available material and what I could find online I became a little more knowledgeable, but admittedly a lot more confused. For the purposes of this chapter, my understanding is that from the UK perspective the role of the design manager (DM) is distinct from the project manager (PM) or the construction manager (CM) in that her or his decisions and actions are taken through a lens that prioritizes the value of the design. While the PM focuses on budget, time, and quality and the CM interprets the construction documents to execute the design safely and effectively, the DM must coordinate, oversee, and manage all of those constituents and their activities to ensure that the design vision is upheld and thrives.

I also gathered that the use of design managers in the UK has ballooned since the early 2000s, and with the increased recognition of 'value added', those design managers are often now being introduced early on, including at the predesign or feasibility phase of the appointment. The demand seems to be fueled by a variety of sophisticated stakeholders who recognize and champion the inherent value of the design of the project. One of the industries that use DM services more than others seems to be construction, especially when they are involved in design-build assignments. DM services are also used by several architecture and engineering firms in the UK that are trying to gain insight beyond that of the narrow, project-specific 'lessons learned' by looking at the bigger picture of the overall workings of the firm.

By documenting, understanding, and publicizing these long-term trends, the entire firm can benefit and grow. Another source noted that owners themselves may retain DMs when they need an outside view independent of the already retained design team: someone to look at the project from the outside in, mine it for inefficiencies, and expose any lack of coordination and unnecessary expense of detailing – in short, a peer review function to trim inefficiencies.

What I did not find to date (but I hope that it does exist) is more information on what I would consider the 'holy grail' of design management services, wherein owners not only recognize and understand the value-add of DM services, but also actually insist on integrating those services at the inception point of all of their critical projects. Where is that central marketplace where US owners intuitively comprehend, value, and seek design management services? See Figure 6.1.



6.1 UK design management theater

A Connecticut Yankee in King Arthur's Court
(Paramount Pictures, 1949)

MY FIRST WEEK of open shop in January 2016 was spent evaluating website concepts presented by Red Pepper Marketing, troubleshooting IT glitches (I had switched to MAC – what the hell was I thinking?!), and spreading word of my new business, all the while searching for clients. At the same time, I heard about a statewide membership group formed in 1952 called the Connecticut Building Congress (CBC), which its website describes as "the premier organization for Connecticut's building professionals to develop strong industry connections". Coincidentally, the following week the CBC was holding a panel-style event entitled "Who's Got Your Back? Does an Owner's Representative Really Bring Value to the Project and the Team?" Setting aside whatever mixed messages the event's title may convey, what perfect timing for a seeker of knowledge about design management services! Guest speakers included representatives from several project management services firms, as well as State of Connecticut employees who were responsible for procuring and delivering public projects. During the event I was able to glean the following:

1. The current popular US term for management services appears to be owner's program management services (OPM), though I found equal instances of owner project management services (I'll still call it OPM).
2. There was a lot of great discussion on the value of OPM, the various participants, and the lessons learned – but curiously there were no owners present at the event.
3. In addition to polling those present at my dinner table, I made a point of speaking with several of the panelists after the event. No one had heard of the term 'design management'.

The Belly of an Architect
(Hemdale Films & Peter Greenway, 1987)

I THOUGHT I WOULD TAKE a "shallow dive" into the US architectural profession's position on DM services. A quick search on the AIA website for 'design management' yields surprisingly few coherent results. In true AIA fashion, the first hit is for a contract form (B171–2013), used when an owner is involved in more

than one project "and where design management services are to be provided under a separate contract with the owner". The description goes on to say that those services should be "coordinated with AIA Document C171™–2013, an owner/program manager agreement, where the program manager is an independent adviser to the owner throughout the course of the program". The language jumps back and forth between 'program manager' and 'design manager' nearly at will, and of course you need to buy the contracts themselves – an expense I was not disposed to incur at this point – to see if there are any definitions or greater clarity.

The AIA's annual national convention is coming up this spring in Philadelphia, so I thought I'd look through the vast catalogue of events for roundtable discussions on design management or at least project management that will surely be on the schedule. This year (2016) you can hear actor, pitchman, and keynote speaker Kevin Spacey expound on "his talent for disruption and drive to challenge the status quo". You can participate in elective EL501a: "Subfloor: The Hidden Asset", or "WE313: Building Historic Philadelphia using 70,000 LEGO Blocks". To be fair, there are hundreds of highly informative and creative workshops over the four days, but a search for the term 'design management' yields only "sorry – no results". Substituting the word 'project' for 'design' does yield 34 hits, but they are primarily about the management of risk, finances, and BIM. By my calculation, about a half dozen of the convention offerings might relate in some fashion to the subject of this chapter, the strongest of which is TH107: "Managing Project Uncertainty and Expectations: New Leadership Opportunities for Architects". The description notes that "Architects have the unique ability to impact the outcome of these collaborative interactions, but this role is often clouded by uncertainty or ambiguity." No uncertainties here: count me in for that class!

The Trip to Bountiful
(Island Pictures, 1985)

IT WAS MID-JANUARY when I took Metro North into New York City to chat with representatives of Turner Construction. Turner's preeminent position in the US contracting marketplace is undeniable, with projects throughout North America and an annual dollar volume of work exceeding $10 billion in 2014. The firm's dominance owes much to foresight: Turner's leadership recently created their own team of multidiscipline engineering services that would give them in-house peer

review capacity as well as technical knowledge. As Pat Di Filippo (executive vice president in charge of the eastern seaboard states and Canada) explains, the benefits are already proving to be significant. Under his direction, Turner has added architects, MEP engineers, structural engineers, and curtain wall design specialists to form the Turner Engineering Group (TEG). As a result, Pat noted, "there are less interruptions, more control, and better desired outcome" on those projects when the engineering group is involved. "It's a market differentiator that institutional clients in particular have been quick to notice," he added.

To help jump-start the creation and deployment of the team of internal design managers, Pat leveraged the resources of Turner's parent company, the German engineering and construction firm Hochtief. While the distinct advantages of a DM approach are already recognized in Europe (especially with regard to short- and long-term risks), most domestic construction firms have yet to understand the business benefit of such an approach. Pat eloquently explained Turner's vision in this regard as a "symmetry of equity, constructability and long-term management".

As a follow-up I met with Rob Barbera, a GM/vice president currently running the TEG, with his own Turner roots going back to 1988. Rob's group has the ability to analyze, assess, or validate any design portion of the work, which is especially beneficial when they are involved in design-build and public/private partnership ('3P') work. While such in-house capacity is still an emerging trend here in the US construction market, there are other firms, such as the Beck Group with multiple locations in the US and Mexico City, that are also pushing the envelope on that front. Rob and I found much common ground, but short of my abandoning my newly formed independent consultancy practice and joining the 'design' side of their contracting forces, a project-specific assignment may be difficult to arrange. This could be in part because the contractor typically arrives midway through the process, and the expense of an additional consultant may be hard to justify, in-house or to the client, at the proposal stage. That said, we are on the lookout for the right opportunity to collaborate.

School Daze
(Spike Lee, 1988)

I DECIDED THAT I would revisit my earlier research into the architectural professions' position on design management by looking at the paths to US

professional licensure and, for those who want it, to AIA status. There are a little more than 130 universities and colleges in the US that offer accredited degrees in architecture, as determined and monitored by the National Architectural Accrediting Board (NAAB). According to the NAAB website,

> Obtaining a NAAB-accredited degree is an essential aspect of preparing for the professional practice of architecture. While graduation from a NAAB-accredited program does not assure registration, the accrediting process is intended to verify that each accredited program substantially meets those standards that, as a whole, comprise an appropriate education for an architect.

I called Andrea Rutledge, the executive director of NAAB, and asked for her thoughts on design management degrees and their possible association with the NAAB. As the mandate of the NAAB deals specifically with architectural professional degree accreditation, Andrea noted that they do not monitor other degree programs, so she wasn't aware of any design management programs or the term. She suggested that I look into a similar organization called the Association of Collegiate Schools of Architecture, whose online resource includes a list of all associated degrees available from architectural schools. Under the "Related Disciplines" header of its *Online Guide to Architecture Schools*, there are a dozen associated degree programs listed, but nothing for design management (the closest being "Construction Management/Technology").

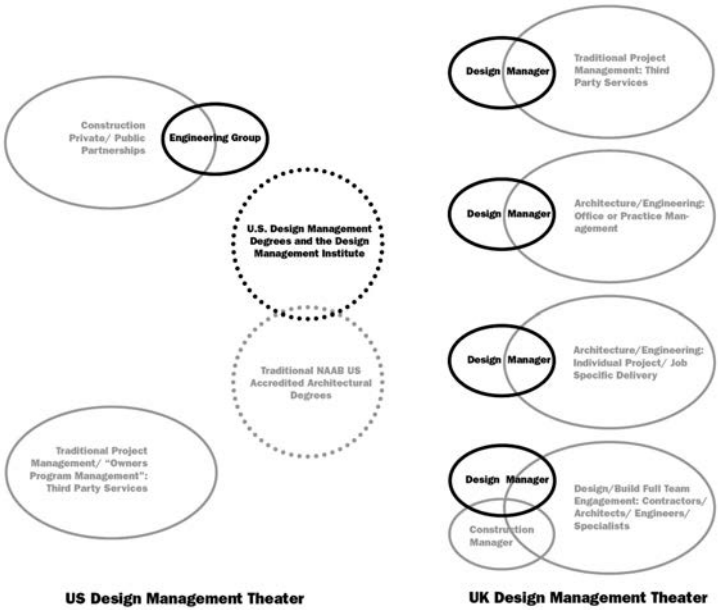
If you Google 'design management' degrees and programs in the US, the results include many for a master of professional studies (MPS) in design management, typically offered in a school of art or school of business. When I focused my efforts on colleges that offer both design management degrees and NAAB-accredited degree programs, I found these programs overlapped at fewer than a dozen schools. Of those, there are strong programs at The New School Parsons School of Design, Pratt Institute, Illinois Institute of Technology (IIT), and SCAD (Savannah College of Art and Design), among others. Pratt's mission statement sums up the general thrust of these programs: "The Pratt Institute's graduate program in design management provides students with a cutting edge, interdisciplinary learning opportunity that integrates design, technology, and business. The program bridges the disciplines of design and business management."

Open Your Eyes
(Live Entertainment, 1997)

TO FOLLOW UP I sent out a few email inquiries to the heads of some of the DM programs where architectural degrees are being offered, asking what type of interaction and possible cross-pollination was taking place between the DM and architecture programs. Bill Lee, chair of the Design Management program at SCAD, was kind enough to write back. When asked, "Does your Design Management program interact with the architectural programs in any way?" he answered, "Yes, I am coleading one of our Collaborative Learning Center (CLC) projects with one of our architecture professors next quarter for an outside-the-university client." As I talked with him to understand more about that collaboration, Bill framed it in the context of their overall agenda.

"Our program has a strategic focus at the intersection of design, theory and practice," said Bill. Design management has evolved threefold since its inception in the mid-1970s, and with this latest DM iteration, he explained, "We are actually teaching folks how to design a business by utilizing a blend of an MBA and the creative side of the brain." Bill added that a central tenet of that approach is to "understand and characterize problems in order to create solutions that people care about". While the breadth of that challenge seemingly transcends the built environment in which architecture and interior design operate, Bill still sees great opportunities with the pairing of the DM and architectural disciplines in his upcoming CLC. Even though he could not discuss specifics because of the confidential nature of the outside client, the collaboration will likely involve aspects of space planning and of furniture and product design. We agreed to speak again after the CLC was completed.

Bill also suggested that I contact the Design Management Institute (DMI), located in Boston, MA, and founded 40 years ago as an outgrowth of the industrial design sector. The website notes that DMI "is an international membership organization that connects design to business, to culture, to customers – and to the changing world". I did talk to Patricia Olshan, program coordinator at the DMI, who noted that while some of the members are in fact architects and planners, there was no specific alignment between the DMI and the architectural community at large (see Figure 6.2).



6.2 US and UK design management theater

Office Space
(20th Century Fox, 1999)

RELIEF AND ELATION: at the end of January I landed my first – and sizeable – commission! The assignment emerged from a relationship with a former client; there are several buildings involved (new, out-of-the-ground as well as renovation), with a tight time frame in which to design, gain regulatory entitlement, coordinate, procure, and execute. The delivery methods, timing, and type of budgeting and constructing interfaces are still to be determined. At my meeting with the owner/client, I explained the philosophy and European underpinnings of my newly formed practice. His response: "Right – you'll be doing project management." Fine for now. I'll get my business on solid footing, and then I'll go out and push the DM cause.

My other current hot potential leads have more depth from an architectural point of view, more so than straight-up project management. One

for an owner involves an early focus on the regulatory entitlement process of a $100 million "new urbanism" style project, closely followed by owner's program management services (OPM) for the balance of the project. Another, even broader opportunity requires analytical planning skills for a very large multibuilding portfolio project in New York City, with the balance of services to be determined after the initial phases.

So far, no one among my current clients and prospects has uttered or written the phrase "design management". No one appears to know what it means, what it does, or why it matters. But I live in hope.

Star Wars: The Force Awakens
(Lucasfilm, 2015)

I WANTED TO GET some perspective from the professionals working here in the US as to what knowledge or opinions might be out there regarding design management. In the hope that the force – and the light saber of knowledge – would be with me, I asked each to show me the way.

William G. Ramroth Jr., AIA, is an architect and author who wrote the game-changing book *Project Management for Design Professionals*, heralded here in the US as the bible for the modern project manager. My well-thumbed copy has been with me every step of my career since the book was first published in 2006. Bill spoke with me recently by phone from the California home that he and his wife designed and built. During the course of our conversation I brought him up to speed with various links to books and articles on 'design management', a term with which he too was not familiar.

Bill noted that he did a few Google searches of his own, adding that while he was working (he retired in 2011) he never came across the term design management used in any way other than as one of the activities of project management. "For example, many times when we went after a project we told our prospective client the qualifications and roles of key people on our design team." He explained, "Often, one of those key people would be designated the design manager, responsible for overseeing the design of the project." On further reflection, Bill said,

> The way the term 'design manager' is being used is broader and more encompassing than in my experience. It seems to stand for a greater

appreciation and understanding of the interconnectedness of the professions of architecture, engineering and construction and the impact of new technologies on the professions, their business practices, and their relationships with clients. So, I think the use of the term design manager in this sense is a good thing. I wish I had thought of it!

Stephen Coulthard is a director at Turner & Townsend Ferzan Robbins, an "independent professional services company specializing in program management, project management, cost management and consulting across the property, infrastructure and natural resources sectors". The result of a 2011 merger with the highly successful US project management firm founded by Peter Ferzan and John Robbins, the megafirm with British QS roots now has offices in 38 countries. Stephen holds a master's degree in engineering from the University of Cambridge and made the pilgrimage to the colonies in 2013, giving him a transatlantic perspective.

Having been instrumental in the project management of several complex and award-winning projects throughout the UK (including his stewardship for the Manchester School of Art, which was nominated for the Sterling Prize) and in China, Stephen uses his technical background to manage and achieve "proper scheduling, proper costs, and proper client challenge". He sees design management as a subset of project management wherein design managers "build the quality", but he questions the appointment of DMs within the contracted architectural firm (likening that to a fox in the hen house). To hedge this inherent conflict, Stephen insists that certain procedures be put into place so that there is proper visibility for all project participants.

Contrasting DM styles and roles across the continents, Stephen noted that the approach is very much dictated by the structure and sophistication of the local construction industry. In China, where project speed is king, design, procurement, and construction activities routinely overlap. "The need for design management is extremely strong there due to the lack of coordination between design disciplines who traditionally work in silos, requiring that those design conflicts be resolved on site," he explained.

Turning to the US and the UK he sees a similar story. "Many architects no longer want the responsibility, or indeed have the skills, to provide a fully coordinated design from concept to construction detailing," he said. To address that issue clients now have the option of securing turnkey project management services from a company such as TTFR. "It takes all management

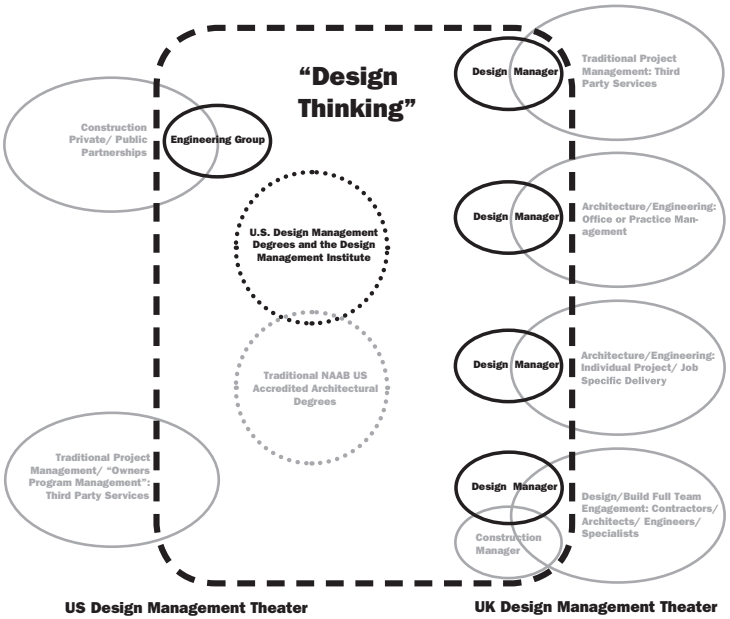
and design responsibility, and ensures that the client has a single point of responsibility for a coordinated design that works within their cost and time constraints," noted Stephen. Are we on the verge of the next British invasion?

Neil Grassie, RIBA, is a Scottish-born architect who graduated with BArch and DipArch degrees from the Mackintosh School of Architecture in Glasgow. He has held the title of regional or global facilities head for several large financial institutions, including the Royal Bank of Scotland Group and Bridgewater Associates. Neil has personally directed many projects of substantial scale (up to $1.2 billion) for various institutions both here and abroad, including the Gogarburn Headquarters building for the Royal Bank of Scotland Group. We recently got together to discuss the use of the term 'design management' services from both a UK and a US perspective.

"Architects have moved too far to the 'art side' of the project, and this conscious dilution of their master builder role has led to a gap that was soon filled by project managers and construction managers," Neil said. He added that "the 'hands on' tradition of architects such as Frank Lloyd Wright, who conceived, designed, and executed every aspect of a commission down to the furniture, has been superseded by architectural firms who only do the design drawings and leave the detailing and execution to others." This "gap in leadership" has led to informed clients bringing in UK personnel to "balance governance and assurance" on their projects, according to Neil. For him, as for Stephen Coulthard, the design management role in the UK has traditionally been a subset of the project management role. "Clients just want to know if the project will serve their vision, how long it's going to take, how much it's going to cost, and how they can realize maximum value for their money." And he added acerbically, "It's what architects used to do."

Pay It Forward
(Warner Bros. Pictures, 2000)

SO WHERE DOES that leave me, approaching the end of the second month of my new practice? I'm going to continue to advocate for the UK spirit behind the term 'design management' (or perhaps *design thinking*?) when approaching potential clients, even though the term appears to be lost in translation here in the US. My vision is to expand my firm with like-minded, architecturally educated individuals who have the ability to connect the dots and are



6.3 The future design management theater

capable of envisioning the full spectrum of the project with all its moving parts. My view is that such a group is not only needed but also essential to 'mind the gap' that exists today between design and contracting services. Moreover, that collective stewardship creates the foundation that can lead to greatness for all parties concerned (see Figure 6.3).

Finally, the term 'darkness' seems to stem from an implied loss of design creativity and control that will necessarily accompany the transition to the 'dark side'. I would say that such an oversimplification is both antiquated and naïve, given the evolving state of project conception and delivery today. In fact, when you examine the multitiered, technologically complex modern building delivery construct with its matrix of specialist disciplines, an argument can be made that a creative and nimble leadership approach to 'design management' may be just as essential to the success of the project as the initial design vision.

Who says that there can't be light on the dark side?

chapter 7

The Beck Group: An integrated approach

Rick del Monte
The Beck Group, USA

Rick del Monte, FAIA, LEED AP, is the chief design officer at the Beck Group. He is responsible for overseeing the proper execution of designs, assuring design continuity and the highest design quality standards on all of Beck's projects. He is passionate about the value of integrated design and construction.

The Beck Group

THE BECK GROUP CURRENTLY operates as one of the largest integrated architecture and construction firms in the US. It is unique in the balance between architecture and construction: the CEO and three of the nine partners are architects. To be successful as an integrated firm Beck feels that it must provide excellence in both design and construction. The current organization was formed by the merger of two firms in 1999, with the mission statement 'revolutionize the industry and create our future'.

The merger

The Beck Group was founded in 1912 as Central Contracting Company firm in Houston, Texas, by Henry C. Beck Sr. The current chairman of the company, Peter Beck, is the grandson of the founder. In the late 1980s a troubled project led to the loss of most of the firm's capital, and Peter decided that the industry was broken. He set out to find a solution to the problem. He decided that a solution might be found with technology. Starting in the mid-1990s Beck proceeded to develop DESTINI (Design, Estimating and Integration), a program that could design, engineer and price a building based on selections

in a series of dialogue boxes. After a few years it became apparent that without architects on board Beck would not have the capability to fully use and develop DESTINI, so in 1999 Beck merged with Urban Architecture, a 46-person office in Dallas also known for its use of technology.

Peter Beck, with Rick del Monte and Kip Daniel, the two original Urban partners, are the remaining partners from the merger. In 2012 a 38-year-old architect who joined Beck through the Urban merger was named CEO. The construction volume is currently at $1 billion, with about 40% of this integrated. The architecture group has expanded to 150 architects in six offices, and is currently ranked as the fifty-ninth largest architecture firm in the US based on architectural revenue.

Management of the firm

Beck is a partnership with nine partners, three of them architects. The firm is organized around a corporate group and six offices. Each office has a director, who can be either an architect or a contractor. Each office has an integrated leadership team, consisting of the head of architecture, construction and preconstruction (estimating). This group is tasked with making sure the region operates as one company rather than as independent architecture and construction groups.

The architecture staff in the offices varies from 8 to 80 (Figure 7.1). Approximately 50% of the architecture volume is integrated work; the rest

7.1 The Beck workplace

is done as a standard third-party practice. The larger offices are organized into a series of studios based on project types: health care, faith-based, mixed use, entertainment, and so forth. The smaller offices typically have one or two specialties. The corporate office is located in Dallas and architecture is overseen by a chief design officer, who oversees design, and an operations officer, who oversees the finances. These are the two senior partners from the original Urban Architecture office. Their role is not only to ensure the performance of each office but also to ensure a high level of cooperation and sharing of staff among the offices.

The profitability of each service is tracked independently to make sure that they remain competitive in the marketplace. Without this tracking it would be difficult to know how efficiently each group is being run. The employee bonuses are, however, based on the overall profitability of the firm, not the profitability of each discipline. Integrated accounting has been a challenge, and the architecture group now uses a construction-based accounting system called CMIC. Adapting this system to an hourly based architecture practice proved to be a significant challenge, but it has allowed the firm to account for the profitability of projects on an integrated basis rather than maintaining two sets of numbers.

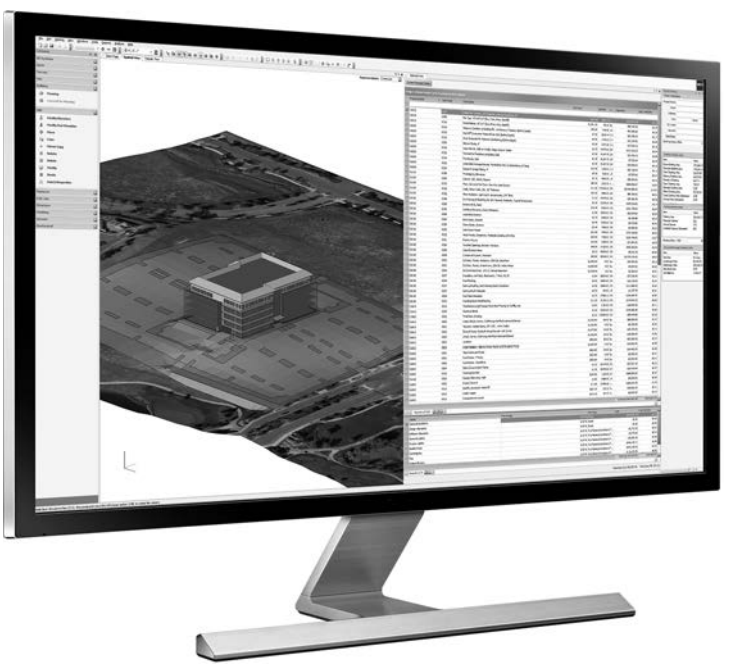
The structure of the firm has been set up to maximize sharing of resources and collaboration. Both the employee and partner distributions are based on the overall profitability of the company, not the profitability of individual departments or offices. The success of integrated projects is based on the overall client satisfaction and profitability of the project.

Beck spends a lot of time recruiting and training employees. To develop an integrated mindset within a fractured industry it is easier to hire graduating students who have not developed negative attitudes towards other team members. Once a person has developed in this system, the firm works hard to provide training and a clear career path so they will continue their career with Beck. Internally the goal has been to break down the artificial barriers between design and construction and to blur the lines between the two roles. Seating arrangements are by teams and not by discipline. Everyone shares the same open office seating arrangement. Young architects will spend between nine months and two years in the field working with a construction team to understand how a project they have drawn gets turned into a building. Salary and bonus reviews are conducted jointly to make sure that compensation is balanced, and focused on the overall success of the team, not just the success of the department.

Technology

The internal development of DESTINI was one of the main drivers for the merger with Urban Architecture. After the merger Beck continued its development for another five years, building a high level of detail and intelligence into the application. It could apply building codes, determine the correct number of toilets and elevators and design the mechanical system. However, this high level of detail and intelligence came at the cost of very limited flexibility, so a new product was developed. This application was called DProfiler, and the decision was made to sell it commercially in 2006 (see Figure 7.2).

The concept of DProfiler was to build a very simple 3D massing model and link it to component assemblies tied to a cost database. In this manner the program can infer that a single line represents a floor plate that contains concrete, reinforcing steel, sprinklers, mechanical ducts and so forth. The individual line items in the components can be easily adjusted to provide



7.2 Technology DProfiler

great flexibility. Creating a 3D estimate at a conceptual level of design allows a team to develop multiple Go/No Go scenarios, which might include scenarios such as structured vs. on-grade parking, site location, multiple low buildings vs. fewer taller buildings and so forth. A typical scenario review would involve a team of decision makers working in real time with a model, examining alternatives in order to come to an overall direction for the project.

Beyond the conceptual phase the design moves into Revit. The advantage of an integrated organization is that there are no barriers for the sharing of information between design and construction. The model can be optimized by the design team for its use in estimating and coordination. Typical architecture firms optimize the BIM for use in creating a set of 2D contract documents; in an integrated environment the model has to be optimized for all of the design and construction activities.

One of the challenges of working in an integrated environment is that the quality of the drawings is no longer measured on the 'standard of care' that applies to typical professional services. Beck is held accountable for all coordination, as well as any errors and omissions, which often falls to the owner in a standard process. So the drawings must be developed to a higher standard. The initial assumption that we could draw less in an integrated environment has proven to be incorrect.

The start of integration: Studio i

AFTER THE MERGER the immediate question was how to bring the two firms together. In order to develop the integrated process a small group of architects and contractors were brought together under the name Studio i. Their first task was to design and build a new office space for themselves in a separate building from the main offices. It took them six months to build out their 4,000 square-foot office. Despite some initial struggles the space turned out well and won a Dallas AIA award. Working through the initial struggles and developing trust among team members have proven to be one of the keys to a successful integrated project.

Soon after finishing their offices they began work on Pinnacle Park, a 250,000 square-foot corporate office building (Figure 7.3). The owner needed to move into the space 11 months from the start of design, and this compressed schedule gave the team the freedom to experiment with the

7.3 Pinnacle Park

process. Subcontractors were brought in at the start of the job to participate in the development of the drawings. The shop drawings for many components were incorporated into the construction documents, creating a series of pre-approved components. This allowed significant overlap between the completion of the documents and the start of construction. The end result

was that the building was completed on time, with a lease rate 10% below the competing buildings in the area. The relationships and working processes developed on the small office space allowed the team to succeed on a much larger scale. The team was also able to incorporate DESTINI, Beck's proprietary BIM software, in the development of the schedule and budget. Their input led to the evolution of DESTINI into DProfiler.

At the end of the project, Studio i was integrated into the Dallas office. The lessons learned from Studio i were used to create the Beck Integrated Practice Manual. It laid out the integrated process and four fundamentals that need to be implemented on every integrated project:

1 Define the criteria before you design the job.

The team must focus on developing a clear game plan before committing to a design or a budget on a project. Some projects may start with a Charrette or conceptual design to help an owner define the project, but before moving into schematic design the team needs to have the criteria clearly defined. They need to understand and align Beck's and the owner's standards for success. They must diligently and consistently spend the appropriate amount of time preparing a program, budget, and expectation of quality through outline specifications, as well as ensuring that they have defined a schedule for the project.

2 Select the integrated project leader (IPL) at the beginning.

Every project must have an IPL as every good team must have a captain. The IPL needs to be a facilitator, a key point of contact with the owner and the internal orchestrator of the team. The IPL is the person ultimately responsible for the integration of the team, the application of integration standards and the overall delivery. This person must be a skilled technician, and an even better leader.

3 Collocate the leaders of the team.

Living together allows for quicker responses, makes input from all members easier, speeds up trust and on-boarding and creates a sense of ownership of the project for the entire team much earlier. As part of this strategy it is vital for key members of the team to not only live together but also involve each other in all aspects of the project. While Beck is building a 'firm-wide' approach to architecture, making it possible to

leverage the design talent across the entire company when necessary, it is vital that the leaders of the project be collocated to speed up trust and effectiveness during the implementation of projects.

4 **Establish the key team early and keep them together.**
Keeping the team together is as important as selecting the team early. Keeping teams together means less opportunity for communication gaps and fractured decision making. Teams develop chemistry over time, and in a real sense it would be good to have teams work together over multiple projects as cross-disciplined teams. While multiple projects together would be ideal, it is essential that once a team is established at the beginning of the job, team members are not removed from the team midstream; this halts momentum, causes losses in information and is distracting for the team and owner.

Using the fundamentals and the lessons learned from Studio i, Beck began expanding its integrated services across the company. The integrated portion of the work has gradually expanded to make up 50% of the overall volume of the company and 100% of the healthcare work. From this work, case studies were prepared on multiple projects so the lessons learned on those projects could be shared with other team members. Ahead are two of these case studies.

Case study 1 – federal office building

Start date: March 2011
Completion date: April 2013
Building type: 9-story, 252,000 SF office tower + 1,000 space parking deck; final project cost: $75,000,000
Project location: Atlanta, GA

Setting the stage

This federal agency had bought past projects using a design/build approach. They preferred it over conventional design/bid/build, but were frustrated with the poor relationships between construction and architecture firms who formed 'shotgun marriages' for individual projects. The federal agency shortlisted five teams, including Beck, for consideration to design and build its newest office tower on a campus

in Atlanta. Each team's proposal included a design response to the requirements listed in an outline specification document, based on a similar building directly adjacent to the new building site. Beck proposed a design that exceeded the quality of the adjacent building in many aspects, including enhancement to the main lobby area, the landscaping package and selected finishes.

The proposals included a lump sum cost for design and construction services. Beck did not propose the lowest cost, ranking second lowest. Beck's schedule was very aggressive, listing a completion date two months prior to the federal agency's stipulated date. This was an important factor, as the agency was eager to move into the new building and stop paying rent for off-campus office space. During the project interview the federal agency felt the culture of the Beck team was similar to its culture, and it was clear the team members knew each other well. Despite Beck's disadvantage of being the only team that had not previously worked on the campus, the federal agency 'took a chance' and awarded Beck the job.

Team structure and management

The architectural team was led by a project manager with extensive experience working on integrated Beck projects, with a deep knowledge of the construction process. The design principal was out of the Austin office and very experienced with office buildings of this scale. The team started the project in the Atlanta office, working closely with the head estimator to help develop the cost for the project. Once construction started the entire Atlanta architecture team moved out to the job site. The construction project manager was a senior Beck employee and was made the integrated project leader. This position is responsible for overseeing all aspects of the project, including the client relationship. The position can be filled by either an architect or contractor. In this project the position was really shared between the two key individuals leading the construction and architecture teams.

Scope and budget management

When the federal agency notified Beck that it had won the project, it also informed it that the budget included in the proposal was the final contract amount. The team had expected budget refinement when the federal agency provided further detail about the project. Beck's proposal included a fairly developed design package, closer to a schematic design than just a conceptual package. This allowed Beck to get pricing input from the major subcontractors, bringing early validation to the larger budget items.

The journey leading to the successful completion was not an easy one. At points issues arose that threatened the success of the project. The team credits their willingness and ability to collaborate as a major success factor.

A significant challenge was a lack of clarity across the Beck team, their consultants and the specification writers on what they were contractually obligated to provide. There were many documents that collectively encompassed the project scope, including the bridging documents, outline specifications, a written narrative in the proposal and the request for proposal requirements.

A lack of coordination between the specification writer and the owner's outline specifications caused a significant impact. A lesson learned for the team was to place greater focus on coordinating across these documents.

The team bought several of the major trades under a design-build agreement to help develop the design while adhering to the budget. Early in the design process RFPs were sent to mechanical/plumbing, electrical, fire protection and curtain wall subcontractors. Four to five firms for each scope were interviewed. Selection criteria were based on cost, but also heavily considered qualifications included their BIM capabilities and ability to collaborate. The mechanical/plumbing and electrical firms were selected under a guaranteed maximum price, not a lump sum agreement, allowing for greater cost transparency. Images of the project can be seen in Figure 7.4.

7.4 Federal office building

7.4 continued

Reflection

COMMUNICATING THE CONTRACTUALLY agreed design scope across the team is challenging yet critical to integrated delivery.

The design/assist process for the mechanical scope was a particularly important aspect of keeping the project within budget. When proposals were first received for the mechanical scope, all of the bids were higher than the target budget. The lowest number was about $1 million over the target. Even though these prices were based on early design information, this was a considerable portion of the budget to reduce. The selected subcontractor was awarded the project, provided they worked with the design team to create a functioning system that could be purchased for the target budget. The design-build team was able to find efficiencies in the design and delivered it for the target amount. The team considers this collaborative effort a major accomplishment and a strong factor in the project's success.

Although the nonmajor trades were not bought using a design-build agreement, the team collaborated with bidding subcontractors to establish a final scope that met the design requirements and fitted within the budget. Door hardware, always an important scope, was an example of collaboration

between subcontractors, architecture and construction. One of the subcontractors was brought in to collaborate with Beck, working through coordination issues and finalizing the scope. The job was not committed to them; they still had to compete on cost, but they had input on the design and the final scope. They ultimately were the lowest bidder. This may seem similar to what takes place on conventional construction projects but the difference was the close involvement of the design team in the process. These coordination meetings took place on-site with the entire team, allowing decisions to be made quickly. The team emphasized the value of reviewing subcontractor scope packages with the design and construction team prior to release. This helped make sure everyone was on the same page, and to catch gaps in scope that may otherwise have been missed.

The integrated project leader was tasked with deciding what to do when the team could not reach agreement. The IPL for this project was a project executive with a background in construction. He tried to judge fairly and in the best interest of the project on issues where the design and construction team members were in disagreement. This was a difficult task at times, but a necessary one to maintain balance of the added risks and responsibilities Beck assumes on integrated projects.

The Beck team compiled a list of the major value-added items they delivered to the federal agency over the course of the project. These items include design enhancements that were included in the original proposal, absorption of owner-driven schedule impacts, and other items that the team accomplished through integration.

Fast-track schedule challenges

Once Beck was awarded the project the team was released promptly to begin design work. The schedule was 'fast-track', with construction beginning on the early packages before the rest of the project's design was complete. The schedule was compressed further with the addition of a floor to the building by the federal agency midway through the schematic design phase. The project budget was increased for the added scope, but no extension was given to the federal agency's contractual completion date. The permitting process for the city also delayed the start of the project. The Beck team worked closely with the city to mitigate this impact, allowing them to start construction on the parking garage. The main tower would not start without the issuance of the storm water permit, which was delayed two months. This delay was

absorbed into the schedule and did not extend the completion date. The schedule demands put considerable pressure on the Beck team. It was clear that the time constraints would be the one of largest challenges facing the project.

Efficiency and good communication were central to completing the project successfully. The team put priority on collocating the construction and design team as much as possible. The team attributes collocation to fostering collaboration, multidisciplinary thinking and rapid decision making. The team initially collocated in the Beck Atlanta office during early design and preconstruction. When construction started, the architecture staff moved on site.

The on-site collocation was critical to meeting the compressed schedule. The fast-track schedule caused the concrete structure to be poured prior to the completion of the rest of the design. The designers were actively involved in the field with edge form layout to help coordinate with the articulations in the curtain wall. In-slab conduits were also an area of heavy coordination. The design team gave direction in the field for outlet needs where they were not yet shown on the documents. Spare conduits were included to provide some flexibility. The design team's involvement with on-site coordination was constant and critical to fast-track delivery.

The early involvement of the major trades also proved critical to meeting the schedule. The mechanical subcontractor and engineer especially worked well together. The subcontractor was heavily involved in the mechanical design process, allowing them to begin shop drawings before the design was finalized. This resulted in an expedited shop-drawing process, where in some cases, completed shops were produced within five days of the design being issued.

BIM was a significant part of the team's coordination process. Not only used for 3D coordination and clash detection, it also helped the team visualize what the completed project would look like. The 3D visualization brought light to coordination issues that were not likely to be recognized early through a conventional 2D process. This allowed the team to be more proactive and work through issues prior to the work going in. This helped the flow of work in the field as well as reducing rework. The Revit model was used to extract layout points that were loaded into the robotic total stations. The radiused perimeter of the building and walls that were not square to each other made layout a difficult task. The Beck team did layout for many of the trades who

did not have robotic station capabilities. The accuracy and efficiency of the robotic layout helped the work keep pace with the fast-track schedule.

Team communication and staffing lessons learned

The team credits their ability to collaborate and work across disciplines as the key to getting this project completed under challenging circumstances. While they did this well, there are areas where they would do things differently to improve communication.

The team recognized early that frequent communication would be important to keeping alignment of scope and budget as the design progressed. They set up a standing weekly meeting to review details during design. However, when attendance at these meetings began to fall off, problems ensued. A key lesson learned was to get more early input from field superintendent staff. This can be difficult sometimes, given the limited availability of superintendents to engage in preconstruction and drawing review. However, experience has shown that construction superintendent input into the design documents is extremely valuable.

Because of the tight schedule, the team felt pressure to start designing immediately. In hindsight, the team should have been more deliberate up front to strategize and develop a more thorough process plan. The tight schedule and complexity of the project led to confusion at times. More organization within the decision-making process, such as implementing a decision-making log, would have helped bring clarity across the project team.

The team strongly emphasized the importance of having the right people in the right positions as a key to making integration work. The federal agency team had a good culture of working together and doing what was necessary to get the job done. It was important that everyone on the team had this attitude.

The team had the right people, but at times they were understaffed, which caused considerable stress. On reflection, the team noted that accomplishing success at the cost of high stress levels is not sustainable. They believe that with additional resources dedicated at the right points during the project, stress levels would have been reduced.

It was important to maintain engagement from the estimating staff throughout the buyout process. The preconstruction manager had a deep understanding of the design intent but stepped out of the project to focus on other projects earlier than was ideal. Keeping the preconstruction manager

engaged for longer would have helped bring continuity to the complex process of finalizing scope and budget.

The design team felt they were at times scrambling to keep up with the schedule. This required all of the architects, including the project manager, to hold production responsibilities. An additional production architect on the team would have freed up the project manager to provide valuable coordination with consultants and the specification writer. This person was not covered in the architectural budget, a significant reason why the role was not added. The team's lesson learned is that on fast-track projects the design staffing plan and budget need to adjust accordingly to meet the demands of a compressed schedule.

During the construction phase the team should have had a dedicated quality control person to catch items that may otherwise be missed in the rush. The project would have also benefited from a dedicated MEP superintendent as well as in-house MEP expertise within the Atlanta office to assist with preconstruction and provide a peer review for the MEP documents.

The team acknowledges that while these changes would be in the best interest of this project, the resource needs across the firm make it difficult to have exactly the right resources available when needed. Considering the risk Beck assumes when we integrate, it is important to do what we can to give priority to these projects.

Case study 2 – university residence hall

Start date: fall 2011
Completion date: summer 2013
Building type: 11-story, 193,000 SF university residence tower; final project cost: $34,500,000
Project location: Florida

Setting the stage

Beck has a 14-year relationship with this university and over the years has built four dormitory towers and several other small projects for it. While Beck had completed smaller integrated projects on the campus, the university was initially not interested in integrated delivery for larger projects. Their interest in integrated delivery grew when they learned about the AIA integrated project delivery (IPD) process from their colleagues at other universities. They

also learned about the potential value of prefabrication. The university would experiment with both on its newest student housing tower, Residence Hall 7.

Five teams were invited to respond to an request for qualifications for a new residence hall, specifying an IPD process for the delivery method. The university selection criteria included team member qualifications, building type experience, IPD experience and BIM. Beck was determined to be more qualified than the other teams proposing and was awarded the project.

Initially the university was hesitant with Beck Architecture serving as architect. They did not feel Beck's design team had relevant experience, and were not yet comfortable with the team's capabilities. Beck brought the university to their Tampa and Dallas offices in order to meet the staff and gain a better understanding of the firm's resources and experiences. That assured the university that Beck Architecture could do the job.

Client changes

The student residence tower was a straightforward project with an achievable budget. Beck's Tampa team had built several residence towers before and knew how much they cost. What made this project challenging was the schedule and, in particular, late and frequent changes made by the client. This was not unexpected. The decision-making process among the various university departments that were stakeholders in design and construction matters was known to be complex and late changes were not uncommon.

The largest change to the project scope was the addition of three floors to the building during schematic design. This raised the building from 8 to 11 floors. The university also wanted a major prefabrication element incorporated into the project. Exterior prefabricated wall systems were evaluated and determined to not be a good fit for the project. After consideration the university was quickly sold on the concept of prefabricated modular bathroom units. These bathrooms are built in a manufacturing facility, delivering a superior quality product in comparison to traditional on-site construction. The repetition of similar bathroom units in the building created an opportunity for the pods to potentially save time.

The decision to move forward with the pods was made during schematic design. Eggrock, an Oldcastle company, was selected through a competitive bid process between the three largest prefab bathroom manufacturers. The units were not a lower-cost option than conventional construction; however, it was felt that they would provide schedule and safety improvements. Both the change in project scope and the inclusion of prefabricated

bathroom units caused the design process to compress. The team had to back up and make adjustments for this additional work within the original design schedule because the construction start date remained the same.

The inclusion of the pods created more of an impact than the addition of three floors. Modifying the already approved room layout to accommodate the pods presented a major design challenge for the team. Pods can provide efficiencies and time savings when room layouts are designed initially with pods in mind. However, these efficiencies are hard to achieve when an existing room layout is modified to accommodate them. Minimizing pod types/configurations, coordinating with shaft wall and rated wall assemblies adjacent to the pods, and access are all factors that require consideration to make the pod installation efficient. The team did what it could to accommodate the pods within the established room layout but had to add walls to achieve shaft wall and fire wall ratings as well as other additional work. In the end, the pods did not bring the hoped-for time savings to the project.

Teamwork

The majority of the Beck team had just completed another integrated project together, a medical building for the University of South Florida. It was a complex job that taught the team a lot about integration, as well as about each other. While working together helped build familiarity, more important was the time spent together away from work. Friendships were built through mountain bike riding and socializing outside of the office. Based on those experiences this team proved that friendship and trust aren't just soft and illusive concepts. Combined with equal parts competence, this team regards its trust of one another as the key to the successfully delivery of this project under challenging circumstances.

Beck's Tampa architecture group grew their staff for this project. Growing the department at the same time that project production needed to begin was challenging and caused a slow start. This challenge, compounded by client changes, resulted in some of the design packages being rushed. These were issued without the level of review and completeness that the team would have liked. Building from incomplete information was challenging, although the construction staff knew the tough position the design team was in. There were times when the construction staff helped out, picking up the slack, and everyone on the team worked hard and contributed. While there were disagreements and frustrations along the way, everyone was working towards the same goal. Images of the project can be seen in Figure 7.5.

7.5 UoF, Tampa

Reflection

WHEN TEAMS ARE able to continue working together on multiple projects, they generally perform better as they become more familiar with each other.

The team worked closely together in groups to work through the issues – and the group meetings were frequent because there were many problems. However, the team viewed these as everyone's problems to solve. These were not architectural, estimating and construction problems; they were 'just problems'. The architectural project manager commented that the most powerful part of their team was how quickly they could resolve issues. If a late mistake in the plans was discovered and the best solution was adjusting a partition location, moving a sleeve or something similar, he could give that direction and it would be done immediately. The team exhibited trust that his decision was best for the project and did not question ulterior motives.

The strength of the team allowed the integrated project leader, who also served as the construction senior project manager, to focus on managing the client's needs and the financials. It was unnecessary for him to officiate disagreements between the construction and design staff, as IPLs are sometimes forced to do. The team understood the project goals well enough to work through those issues on their own.

A key member of the project team was the lead estimator. He was the 'glue' that kept the design in line with the budget. He was deeply involved during design development phase and helped the design team work towards target budgets. He also worked closely with the construction staff on the subcontractor buyout. He kept a hand in the project throughout and is credited as being a significant part of guiding the project to a successful financial outcome.

Project partners

Under the project's IPD agreement the major subcontractors and design consultants were brought on early as partners. They all put a portion of their fee at risk in a shared pool, which the client would match at the completion of the project if the project goals were met, and the cost did not rise above the target budget. The subcontractors and design consultants were selected based on qualifications to collaborate effectively and be a strong member of an integrated team. Over the course of the project it became clear that some firms were better at doing this than others.

One example in particular was the team's experience working with the MEP engineer as compared to its experience working with the light gauge framing and drywall subcontractor. The difference in their expertise was not as significant as the difference in their approach to integration. The MEP engineer was not collaborative. He was reluctant to spend time exploring options during conceptual design. In short, he wanted to be given backgrounds, at which point he would do his design and hand it over to be priced. Despite efforts by Beck and the rest of the team to get him to change his behavior, he did not. He provided a duct layout that was not coordinated with other elements of the building, causing the mechanical subcontractor and Beck to spend considerable time coordinating and rerouting the duct. The engineer claimed he did not have the money or the time to engage further in the process. When issues arose his response was inadequate.

The light gauge framing and drywall subcontractor took the opposite approach. The owner of the firm directly engaged in the project. He met frequently with the architects to understand design intent and provided working solutions that were also affordable. His close collaboration with the architects helped them to more efficiently complete the document set. This was the case with the layout plans. During a work session he indicated the dimensions that he needed and the ones he did not. He also highlighted sections and details that were critical and the information needed on them. This allowed the architects to focus on what was needed for construction rather than spending time detailing information that was not required. These kinds of working relationship with the subcontractors allowed the design team to draw more efficiently.

Beck considers this subcontractor an extension of its team. Since the completion of this project he has become a common fixture in Beck's architecture office, reviewing plans and SketchUp models. It is critical on integrated projects to identify consultants and subcontractors who are able to work in an integrated environment.

Value of integration

At the completion of the project the team had successfully met the four goals established by the client at the onset of the project.

- Schedule – The project finished early and absorbed the addition of three floors and several owner-directed changes, and accommodated an accelerated furniture move-in date.

- Value – The final cost per square foot was lower than any of the other four residence towers Beck built on the campus. The project included several design enhancements that others did not, including a solar hot water heating system and a LEED Silver rating.
- BIM – The team delivered BIM content in accordance with the university's BIM execution plan. It provided coordination value during design and construction and was delivered in a format that could assist with facility management after turnover.
- No change orders – The client did not receive any contractor- or architectural-initiated change orders.

The team feels strongly that a nonintegrated team could not have met these goals, especially the schedule.

Lessons learned

The project was successful but the team would do certain things differently in the future to improve the process. The design team would dedicate more resources early in the design process to develop the documents to a more complete level earlier than they did. The challenges they experienced while completing the design as the work was going in made it clear that early and complete information is fundamental to maximizing the efficiencies of integration. To help develop the design efficiently, they would also incorporate into the project schedule an appropriate amount of time for drawing review and input from the building trades prior to issuing a set.

The team felt it would have been valuable to develop an integrated delivery plan to build a clear understanding of the project objectives across all the team members and how they were going to meet these objectives. This would include Beck's criteria for success, a shared financial plan, integrated staffing, project challenges and the team's solutions to meeting them. This plan would bring additional structure to the integrated process.

Conclusion – final thoughts on the integrated firm

IT HAS BEEN 17 years since the merger and it has been a challenging but highly rewarding time. Few architects or contractors get the ability to look behind the curtain and see the operational and financial structure of the other profession.

Understanding others' financial motivation and sharing a common bottom line go a long way towards helping teams work together more effectively.

It takes time to change the culture of organizations in an industry used to being in adversarial relationships with the other professions. The more teams work together, the more effective they become. Once they have an opportunity to work on an integrated project, very few people are willing to go back to a traditional adversarial process. The integrated profitability has not been dramatically higher than a traditional third-party process, but the experience has been better for both the clients and the staff. Some final thoughts for those considering a merger with another group:

Choose your partner carefully: do not underestimate the fundamental differences between architects and contractors. For an architect it is critical that a potential construction partner cares about design quality at least as much as they do. Likewise an architect needs to care about budget, schedule and process to be an effective partner on the team. Before the merger Beck and Urban spent nine months in intense dialogue, including cultural and psychological profiles of all the partners. Without this cultural alignment the other challenges would have been impossible to overcome.

People matter more than processes: even with the best processes, people who are not collaborative will disrupt any team. Selecting the right people and spending time to develop the relationships among the team members are as important as optimizing the process. It is also important to make sure that employee incentives encourage collaboration and overall project success rather than the success of the individual disciplines.

Changing the building industry is a huge challenge: there are deeply entrenched institutions that are based on the separation of architecture and construction: university departments, professional associations and program managers, to name a few. The idea that architects and contractors can work as one firm to build a building can be a very difficult idea to sell. However, the focus on collaboration has really accelerated in the last five years, and the AIA's integrated project delivery model has helped to open the eyes of many owners to alternative forms of project delivery. In the future these alternative delivery models will continue to grow, offering an owner a way to reduce the risk and improve the efficiency of the delivery process.

chapter 8

Veidekke: Collaborative planning in design

Vegard Knotten and Fredrik Svalestuen

Vegard Knotten, MSc, has over 20 years of experience in the AEC industry and is currently pursuing an industrial PhD at the Faculty of Architecture and Fine Arts at the Norwegian University of Technology and Science. The topic of his PhD is the early stages of building design. In addition to his PhD work he is currently employed by Veidekke Entreprenør as head of design management development.

Fredrik Svalestuen, MSc, is currently pursuing an industrial PhD at the Faculty of Engineering, Science and Technology at the Norwegian University of Technology and Science. The topic of his PhD is communication in design. In addition to his PhD work he is currently employed by Veidekke Entreprenør as a site manager.

Veidekke

VEIDEKKE IS THE largest Norwegian construction company and the fourth largest in Scandinavia. Veidekke's business involves a network of Scandinavian construction operations, rehabilitation work, major heavy construction contracts and also the development of dwellings for the company's own account as well as buildings for public use.

Veidekke's roots go back to 1863 in Denmark (H. Hoffmann & Sønner) and in 1896 in Norway (Høyer Ellefsen). Veidekke was founded as a company on February 6, 1936 by Nico S. Beer and Gustav Piene. In its early years Veidekke was primarily concerned with constructing roads and laying cobblestone. When the Second World War broke out the company fulfilled all signed contracts and then shut down all operations until after the war. In 1948 the small and virtually unknown Veidekke won the contract for construction of runways at

Stavanger Airport, Sola. This was the first of a number of major airport contracts for Veidekke and the start of its growth into a major construction business. The company's core activities are now linked with construction, property development and industrial operations (asphalt/aggregates and road maintenance). Veidekke has developed expertise in concrete works, carpentry and road operations and has a clear ambition to be a leader in these market segments.

In an effort to increase efficiency and effectiveness (Samset, 2010) of both construction and design Veidekke started to look at a new way to conduct the design phase of construction projects. This resulted in the implementation of an approach called collaborative planning in design (CPD). In this chapter the key elements of the approach are described, supported with examples.

Collaborative planning and collaborative planning in design

IN 2002 VEIDEKKE started exploring means to increase productivity and reduce sick days, with an improvement process inspired by lean construction called collaborative planning. Implementing tools like the Last Planner System and focusing on collaboration led to better control over the production process. Letting the workers plan their own work increased their responsibility and also their involvement in their work. This change also resulted in workers taking fewer days off sick. The Norwegian skilled workers are independent and are used to having a high degree of involvement in the way they solve their tasks. However, they were failing to deliver to schedule because of late or missing information from the design team. We found that the designers could not keep up with the demand from production. Therefore, Veidekke started exploring the means to increase productivity in the design phase and at the same time started to bridge the gap between the designers and the constructors.

A workgroup of design managers in Veidekke started working with the task of adapting the work of production towards design. This was undertaken based on the principles of collaborative planning. The work resulted in a guide to collaborative planning in design (Veidekke, 2013) for use by the company. The original guide is written in Norwegian, and the English version was made for the International Group for Lean Construction (IGLC) workshop in 2014. Unfortunately it has some peculiar translations of the technical terms of the process. We will therefore try to explain CPD with the most commonly used terms.

Theoretical background to collaborative planning in design (CPD)

The theoretical background of CPD is based on five foundations. They are listed here, and will not be discussed further in this chapter.

1 Both design and production are value-creating processes consisting of transformations and flows (Koskela, 2000).
2 Both design and production can be managed through the Last Planner System (Ballard, 2000).
3 There can be pooled, sequential, reciprocal and intensive interdependencies between tasks (Bell & Kozolowski, 2002; Thompson, 1967).
4 Both design and production are logistical, economic and social processes (Andersen et al., 2008).
5 Dialogue is a precondition for design (Bølviken et al., 2010).

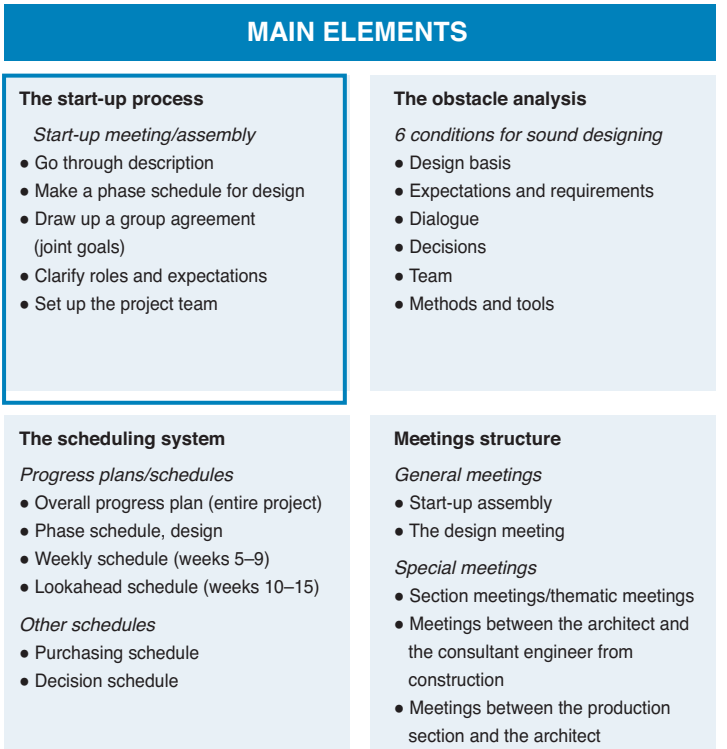
Applying collaborative planning in design (CPD)

CPD IS BASED on four major areas, as shown in Figure 8.1:

- Start-up process
- Scheduling system
- Obstacle (constraint) analysis
- Meeting structure.

The start-up process

Each time a new projects starts it is important to transform the chosen group of people into a team. In Veidekke this is done by having a start-up meeting, or a start-up session. The duration and the agenda will vary according to the project, but these events are highly focused on team building and the further development of the team. Each major participant of the project needs to get to know each other, not only what technical knowledge they have but also their interpersonal skills (e.g. team roles, such as plant, research investigator, coordinator, shaper, monitor evaluator, team worker, implementer, completer and specialist; Meredith Belbin, 2010). We know that a good mix of skills is preferable for a fully functioning team, and knowing the diversity of the skill sets in the team is important when it comes to setting the team roles in a project. A social gathering with dinner and some games to increase the trust



8.1 The main elements of CPD

between the different participants usually follows this process. Setting the goal for the project and the rules for the team is another important agenda in the start-up meeting. By involving all the team members in the goal-setting process they become more committed to the goal and hence they are more likely to succeed (Lunenburg, 2011).

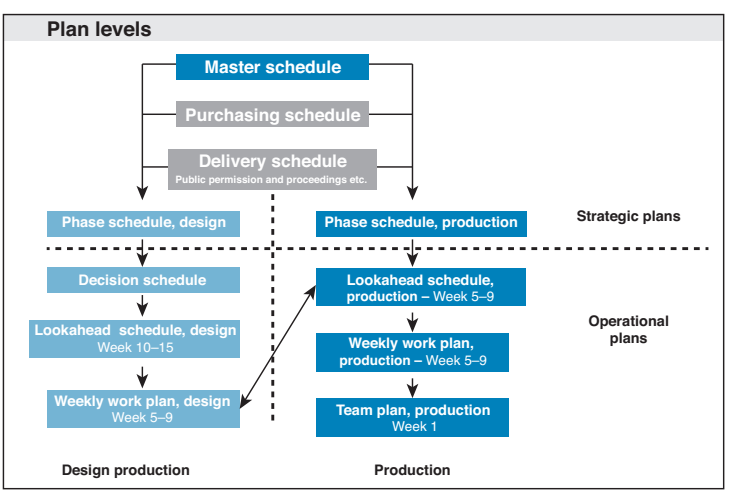
The project manager is responsible for the entire start-up process; however, because the design phase usually starts before the production phase, the design manager is responsible for the start-up meeting. The participants of the meeting are what Veidekke refers to as the core team, which consists of those with the largest interest in the project – that is Veidekke's site manager, client, architect, engineering consultants and the largest of the

subcontractors. The result of this meeting is a 'team-charter' document that describes the goal for the project and a set of rules for behavior within the project team. Another output from this initial meeting is the first design schedule.

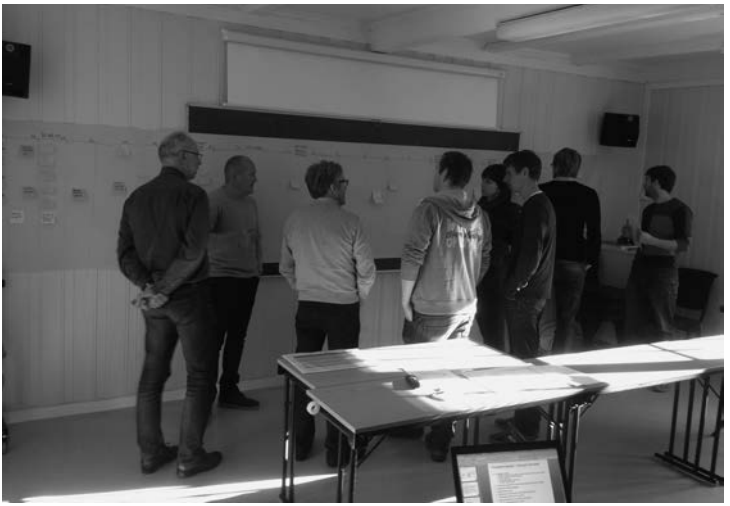
The scheduling system

The scheduling system of the design phase is closely linked to the production schedules. Figure 8.2 shows this connection as it is described in the Veidekke guide to CPD. The master schedule is usually produced in the tender phase, and is part of the contracting document with the client. This schedule sets the milestones for the project, including the start and end dates and other critical dates in between. Based on this schedule the purchasing schedule and the phase schedule are then produced.

For design the first schedule is made in the start-up meeting. This is done in collaboration with all participants of the design team, contractors, subcontractors and the client. Each team member has different colored sticky notes with their deliveries written on them. These are placed on a wall in sequence by the individuals. Important dates concerning the construction start date and end are usually already set, and individuals will place his or her colored notes



8.2 The scheduling system for CPD

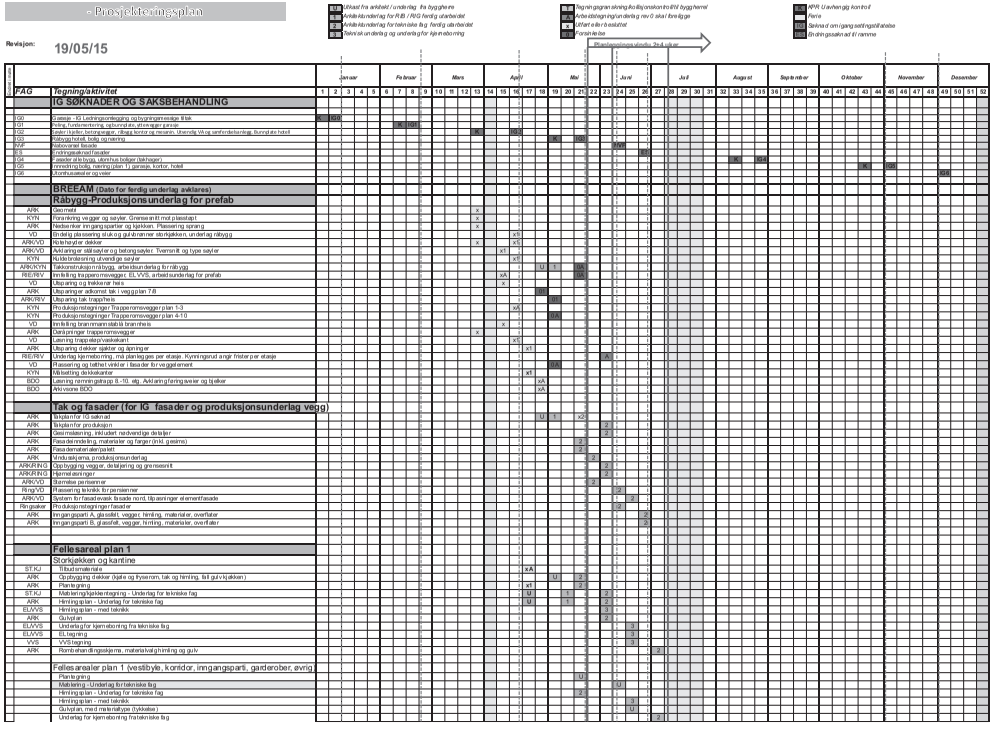


8.3 Collaborative planning from the Sjetnan Nedre project

between these dates. As the notes appear, the team starts to identify and figure out the interdependencies of various tasks, challenging each other to link their activities together. This process involves a degree of compromise as the colored notes are repositioned to better represent the process.

Figure 8.3 shows members of the core team on the project participating in the process of making the phase schedule for one of Veidekke's projects, called Sjetnan Nedre. A comment on this process states that a process like this also involves the team members and creates discussions. One of Veidekke's design managers puts it rather nicely: "It is not necessarily the mapping process which is the most important but it is all the discussions we have" (Knotten et al., 2015). The phase schedule might include all major decisions and dates of public applications, or this can be captured in a separate schedule. It is essential to link the design work to the decisions and procurement, so that there is enough material to make decisions and acquisitions timely.

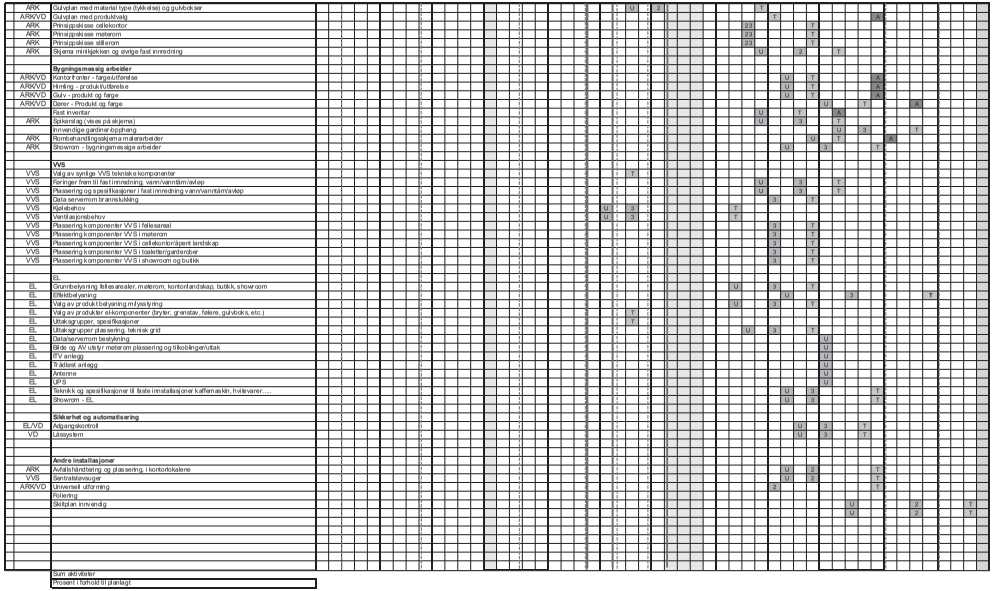
After the phase schedule is made in the start-up meeting the design manager writes the schedule down in a Gantt chart with a tool like Excel or MS Project. This is when the team starts working on the schedule: further breaking down the different tasks, linking them together and removing all the known constraints. Figure 8.4 shows an operational plan for design



8.4 Operational design schedule

	EL tegning												3					
	VVS tegning												3					
	Rombehandlingsskjema, materialvalg himling og gulv												U		T			
	Toalettkjerner																	
ARK	Plantegning																	
ARK/VVS	Valg av møblering og sanitærutstyr/skjema																	
ARK	Himlingsplan - Underlag for tekniske fag																	
EL/VVS	Himlingsplan - med teknikk																	
ARK	Gulvplan, med materialtype (tykkelse)																	
EL/VVS	Underlag for kjerneborring fra tekniske fag																	
EL/VVS	EL tegning																	
VVS	VVS tegning																	
ARK	Rombehandlingsskjema, materialvalg himling og gulv																	
ARK/VD	Våtromsgarnityr																	
	Trapperom																	
ARK	Plan			x1														
EL	Dørmiljø	xA																
VD	Tilpasning råbygg for heis (inkl. trekkerør tablå)	xA																
VVS	Utsparinger vegger (ventilasjon, sprinkler)	xA																
VVS	Utsparinger dekker (røyluke,vifte,sjakt)			0A														
VD	Flis trappeløp, repos, sluse				1						2							
VD/ARK	Rekkverk				1						2							
	Himling								2									
	Belysning/EL										3							
	VVS										3							
	Heiser - Innredning										T							
	Generell leietager																	
	Plantegning med møblering			T														
	Himlingsplan grid		U															
	Himlingsplan m/teknikk, utarbeides ikke																	
	Skjema cellekontor. Himling systemvegg, kontorpult, belysning, grenstav, radiator, ventilasjon, komponenter		U			T												
	Skjema typisk møterom		U				T											
	Systemvegger cellekontor/møterom - valg av produkt									T								
	Himling - valg av produkt									T								
	VVS teknisk utstyr kontorareal - valg av produkter									T								
	VVS teknisk utstyr toaletter/WC - valg av produkter									T								
	Elektro - Belysning - Valg av produkter									T								
	Elektro - Utstyr - Valg av produkter									T								
	Minikjøkken - Valg av produkt									T								
	Gulv - Valg av produkt (tepper, bellegg, flis, annet? Også plassering gulvboks)														T			
	Listverk og foringer										U				T			
	Overflater/rombehandling (utarbeides ikke for generell leietager)																	
	8.etg (ca 3/4 høyre del)																	
ARK	Plantegning med faste rom (fellesfunksjoner/møterom/datarom/arkiv)					U	T				2							
ARK	Plantegning cellekontor/åpent landskap					U	T				2							
ARK	Møbleringstegning for EL					U					T		2					
VD	Spesifikk leietagerbeskrivelse (omforent beskrivelse)					U	T						T		2			
ARK	Himlingsplan grid					U							T					
EL/VVS	Himlingsplan m/teknikk											3	T					
ARK	Skjema cellekontor. Himling systemvegg, kontorpult, belysning, grenstav, radiator, ventilasjon, komponenter									T								
ARK	Skjema møterom									T								
ARK/VD	Systemvegger cellekontor/møterom - valg av produkt									T								
	Foliering									T							U	T
ARK/VD	Himling - valg av produkt									T								
VVS	VVS teknisk utstyr kontorareal - valg av produkter									T								
VVS	VVS teknisk utstyr toaletter/WC - valg av produkter									T								
VVS	VVS - plantegning										T							
EL/VVS	Elektro - Belysning - Valg av produkter									T								
EL/VVS	Elektro - Utstyr - Valg av produkter									T								
EL/VVS	Elektro - plantegning										T		3					
ARK/VD	Minikjøkken/drikkestasjon, tilkobling, møbler og valg av produkt									T								
ARK	Gulvplan type materiale (inkl. gulvboks)							T										
ARK/VD	Gulv - Valg av produkt/overflate(tepper, bellegg, flis, annet? Også plassering gulvboks)														T			
ARK/VD	Listverk og foringer														T			
ARK	Overflater/rombehandling														T			
	3M (1/2 5. og 6. etg)																	
	Planunderlag																	
ARK	Plantegning med faste rom (fellesfunksjoner/møterom/datarom/arkiv)				U		T			3								
ARK	Plantegning cellekontor/åpent landskap							U		2			T					
ARK	Himlingsplan m/grid								U		2			T				
EL/VVS	Himlingsplan m/teknikk/belysning												U		3	T		
	Møbleringstegning som viser plassering og bestykning												U					

8.4 continued



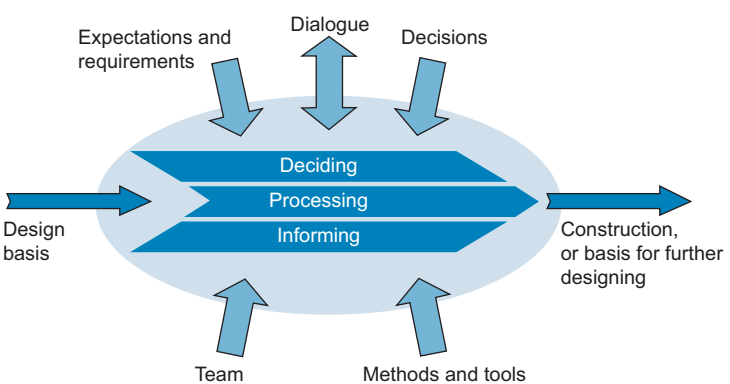
ARK	Gulvtan med material type (tykkelse) og gulvbokser	
ARK/VD	Gulvtan med produktvalg	
ARK	Prinsippskisse cellekontor	
ARK	Prinsippskisse møterom	
ARK	Prinsippskisse stillerom	
ARK	Skjema minstekrav og øvrige fast innredning	
	Bygningsmessig arbeider	
ARK/VD	Kontorfronter - fargeutførelse	
ARK/VD	Himling - produktutførelse	
ARK/VD	Gulv - produkt og farge	
ARK/VD	Dører - Produkt og farge	
	Fast inventar	
ARK	Spikerslag (vises på skjema)	
	Innvendige partier/oppheng	
ARK	Rombehandlingsskjema malerarbeider	
ARK	Showrom - bygningsmessige arbeider	
	VVS	
VVS	Valg av synlige VVS tekniske komponenter	
VVS	Føringer frem til fast innredning, vann/vannlåm/avløp	
VVS	Plassering og spesifikasjoner i fast innredning vann/vannlåm/avløp	
VVS	Data serverrom/ framskaking	
VVS	Kjølebehov	
VVS	Ventilasjonsbehov	
VVS	Plassering komponenter VVS i fellesareal	
VVS	Plassering komponenter VVS i møterom	
VVS	Plassering komponenter VVS i cellekontor/åpent landskap	
VVS	Plassering komponenter VVS i toalettet/garderober	
VVS	Plassering komponenter VVS i showroom og butikk	
	EL	
EL	Grunnbelysning fellesarealer, møterom, kontorlandskap, butikk, showroom	
EL	Effektbelysning	
EL	Valg av produkt belysning miljøstyring	
EL	Valg av produkter elkomponenter (brytar, grenstav, følere, gulvbokser, etc.)	
EL	Uttaksgrupper, spesifikasjoner	
EL	Uttaksgrupper plassering, teknisk grid	
EL	Datarelserverrom belysning	
EL	Bilde og AV utstyr møterom plassering og tilkoblingsrutiak	
EL	ITV anlegg	
EL	Trådløst anlegg	
EL	Antenne	
EL	GPS	
EL	Teknikk og spesifikasjoner til faste installasjoner kaffemaskin, hvitevarer....	
EL	Showrom - EL	
	Sikkerhet og automatisering	
EL/VD	Adgangskontroll	
VD	Låsesystem	
	Andre installasjoner	
ARK	Avfallshåndtering og plassering, i kontorlokalene	
VVS	Sentralstøvsuger	
ARK/VD	Universell utforming	
	Rolleting	
	Skiftplan innvendig	
	Sum aktiviteter	
	Prosent i forhold til planlagt	

8.4 continued

for the project Portalen, where week 5–6 and week 5–9 (before production) are marked up with a red line. The plan shows different color-coding for activities that are sound or activities that need attention. Week 5–9 marks up the weekly work plan for the design team and week 5–6 marks up the dialogue matrix. The constraint analysis, which is further described in the next section, is undertaken in this planning window. The team uses a further collaborative session to remove each constraint in the dialogue matrix. Although the dialogue matrix mainly looks at the planning window in week 5–6, activities in that window might be interdependent on activities further ahead (e.g. fire protection is an activity that needs to be completed early, but it is dependent on the type of locking system used for the building, which is usually a later activity). When dependencies like this are discovered in the matrix the team brings these activities into the weekly work plan.

Constraints analysis

In order to have an efficient design process it is important that all constraints are removed before the task is carried out. Figure 8.5 shows the six constraints of a design process. When all six constraints are removed you can have an efficient design task (Bølviken et al., 2010).



8.5 Constraints of a design process

- First you need the design basis, which means that the input from the other designers needs to be finished – that is the architect's floor plans.
- Second, the expectation and requirements of the client and contract must be clear – for example do you know what to design at this particular floor?
- Third, the team executing the design must have the capacity and competence to do the task – for example do you or your designers have enough time to finish this task before the agreed date?
- Fourth, the methods and tools to do the task must be available – for example computer tools and programs.
- Fifth, all necessary decisions must be taken – that is choices by the client – regarding special equipment to be included in the design.
- Finally, there must be an arena for good communication so that all unexpected problems can quickly be resolved.

We try to create an arena for good communication through the meeting structures and the start-up session. By actually asking these six questions and addressing the issues that are not complete it is easier to deliver on time and to the expected quality. There is, of course, a challenge of converting all of this tacit knowledge into explicit tasks for everyone. When this is present the design process of deciding, processing and informing can begin, ending up in a design basis for another design task or for production. The constraint analysis is usually performed at the look-ahead schedule or weekly work plan in line with the Last Planner. To change the mindset of the design participants in order to fully analyze the constraints in each design task is very difficult to achieve, but worth the effort.

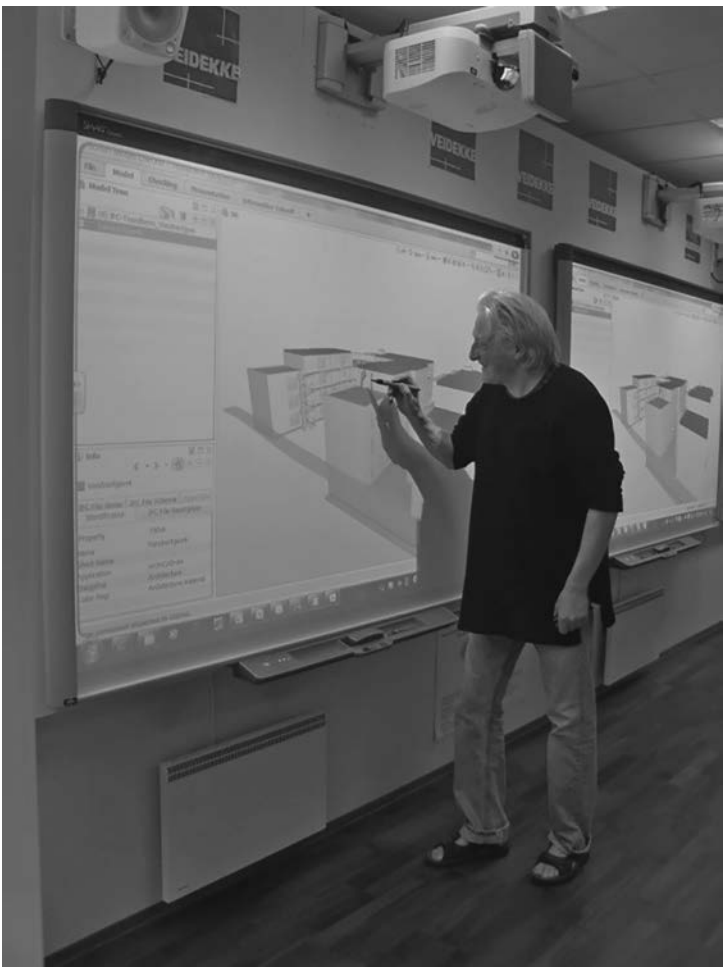
The meeting structure

The meeting structure is proposed to help the design phase (see Figure 8.6). The number of meetings and types of meetings will vary according to the size and complexity of the project. Some projects try to implement several of these meetings through a longer session based on the key principles of integrated concurrent engineering (ICE), working with the same challenges at the same time, with all the relevant stakeholders present.

Typically the first part of the session is to get everyone updated by summarizing the development in the project. Using BIM is an effective way

Meeting	Contents	Recommended date/frequency	Basis and outcome	Recommended participants	Meeting owned by
Start-up assembly for the design process Post-it note meeting	A process (using the post-it note technique) of generating decisions and design activities is initiated at this gathering. The gathering also marks the starting point for the work on the phase schedule for design.	As soon as all of the designers have signed their contracts	**Basis** Overall progress plan **Results** Phase schedule for design (draft)	Management trio from Veidekke (PM, PRM, DL) All of the designers Owner; possibly subcontractors and suppliers	Design manager
Progress meeting for the design process Design meeting	At the meeting, status updates since the previous meeting are given. Next, activities for the next two weeks are presented and detailed in preparation for production handover. At the same time, the rolling schedules are updated by moving two new weeks from the phase schedule into the lookahead schedule, and allowing two new weeks to glide from the lookahead schedule to the weekly schedule. On some projects, ICE (see below) will be part of the meeting.	Every week or every other week depending on project scope and needs	**Basis** Phase schedule for design **Outcome** Review and updating of lookahead schedule and weekly design schedule, plus preparation of documents for production handover		
ICE-møte Integrated Concurrent Engineering	The ICE meeting builds on the idea that clarification and correct decisions are achieved faster if all relevant stakeholders in the decision are involved and allowed to share in the decision making. This is done by organising the designing at the design meeting as individual or group efforts, in addition to the reviewing and updating of status and schedules.	Every week or every other week depending on project scope and needs	**Basis** Lookahead schedule and weekly schedule **Outcome** Missing documentation needed for further designing is uncovered		
Special meeting **Themating meeting**	Any member of the design team can call this type of meeting. At the meeting, areas or topics requiring closer examination or in-depth attention one way or another are addressed. Thematic meetings can also be dedicated to scrutiny of the project or to going through drawings with the operations unit.	As needed	**Basis** Phase schedule and lookahead plan for design **Outcome** Detailed designing for – or other processing of – selected project areas or topics	Everyone involved in the area or topic addressed by the meeting	Everyone
Evaluation meeting	The meeting is held to adjust for – and learn from – any defects or shortcomings (so far) in the design process.	Halfway through the design process and at the end of the process	**Basis** The design process **Outcome** What can and should be improved	Management trio from Veidekke (PM, PRM, DM). All of the designers Owner; Possibly subcontractors and suppliers	Design manager
Meetings: **Consultant engineer/ Architect** **Consultant engineer/ Operating unit**	Meetings attended by the architect and the production unit. A series of such meetings is also held between the consultant engineer from construction and the production unit. Efficient meetings with few participants, focussed on choosing solutions, and on reviewing draft drawings and progress/priorities.	Once a week	**Basis** Lookahead schedule and weekly schedule **Outcome** Review of drawings, solutions singled out	PRM, Foremen, Gangers/bosses Architect. The consultant engineer from construction	Design manager

to update the design team. By viewing each participant's update since the last session each team member is informed and hence aware of the project development. This also makes it possible to ask questions of the presented solutions if something is unclear (see Figure 8.7). Since everyone is present it



8.7 The architect uses BIM and Smartboard to propose changes in an ICE session

is important to keep this session short, and noting the questions and discrepancies to be solved by the parties later.

The second part consists of different work sessions. The sessions are planned ahead so each session has a clear task to address, identifying who is in charge of the session and who is needed to do the tasks. There can be several sessions going on at the same time, or in sequence. The sessions can be special meetings or meetings with consultants and the production team. The ICE session ends with summarizing the key decisions of the sessions and a look at the design schedules. The aim is to review what has been accomplished and what needs to be addressed in the next period. This also includes unsolved issues addressed in the different sessions. Instead of meeting minutes the session is recorded by using a spreadsheet containing information about key decisions, the work accomplished and what needs to be done in the next session.

The planning of the next period is done by using a dialogue matrix. The matrix is organized in advance so it shows the look-ahead time until the next session. Together with the design schedule, looking at the longer perspective allows the work of the coming weeks to be planned. With a predefined coloring system it is possible to mark and identify what tasks are complete, and what output is expected from the tasks – that is do we need a sketch, a 3D model or complete workshop/production drawings? From the dialogue matrix the design team can conduct a constraint analysis, checking if their tasks can be done, and giving other participants tasks that need to be completed in advance. The dialogue matrix then shows the planned tasks to be done and the relation to other tasks.

Concluding remarks

THE USE OF CPD is based on efforts from lean construction and virtual design and construction (VDC), and some may say that this is nothing new but just the most sensible way to conduct building design management. To this we agree, and conclude that all it really takes is a will to change the way we conduct design management today.

Even though we have a good framework for design management with CPD, we see that there are several ways to use the tools in a project. In Veidekke every design manager is free to choose which tools he or she wants to use, and how to integrate them in his or her design execution plan.

This leads to many different variations of the tools. Acknowledging this, there is an ongoing process to revise the CPD guide so that it will reflect more of the best practice in the use of CPD. This, we feel, will help to improve the level of consistency across projects within the company. The new revision should be finished by the end of 2016.

References

Andersen, B., Bjølviken, T., Dammerud, H. S., & Skinnarland, S. (2008). Approaching construction as a logistical, economical and social process. *Proceedings for the 16th Annual Conference of the International Group for Lean Construction*.

Ballard, G. (2000). *The Last Planner System of production control*. PhD thesis, University of Birmingham, UK.

Bell, B. S., & Kozolowski, S.W.J. (March 2002). A typology of virtual teams, implications for effective leadership. *Group and Organization Management*, *27*(1), 14–49.

Bølviken, T., Gullbrekken, B., & Nyseth, K. (2010). *Collaborative design management*. Paper presented at the IGLC-18, July 2010, Technion, Haifa, Israel.

Knotten, V., Svalestuen, F., Lædre, O., & Hansen, G. K. (2015). *Organizational power in building design management*. Paper presented at the Proc. 23rd Ann. Conf. of the Int'l. Group for Lean Construction, 28–31 July, Perth, Australia.

Koskela, L. (2000). *An exploration towards a production theory and its application to construction*. Doctor of Technology thesis, Helsinki University of Technology. VTT Publication 408, Espoo, Finland.

Lunenburg, F. C. (2011). Goal setting theory of motivation. *International Journal of Management, Business, and Administration*, *15*(1), 3.

Meredith Belbin, R. (2010). *Management teams: Why they succeed or fail* (Third edition). Oxford: Elsevier.

Samset, K. (2010). *Early project appraisal: Making the initial choices*. New York: Palgrave Macmillan.

Thompson, J. D. (1967). *Organizations in action: Social science bases of administrative theory*. New York: McGraw-Hill.

Veidekke. (2013). *Collaborative planning in design – A guide to*. Oslo, Norway: Veidekke.

chapter 9

ARPRO: project delivery in emerging markets — a case study from Colombia

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Rodrigo Rubio-Vollert is an architect from Universidad de los Andes, Bogotá, with a master's degree in design studies from Harvard University. He is the founder of GIV, a research group on housing and urban development based at Universidad de los Andes, where he was appointed head of the School of Architecture in 2002. Between 2007 and 2010 he was the design manager for the Trump Ocean Club in Panama, a 70-story mixed-use development delivered in 2011. He is currently the chief operating officer of ARPRO, a Colombia-based construction company. He is a board member of the ARPRO-ELLISDON Joint Venture, an enterprise in charge of the construction management of Bogotá's ATRIO towers, a 260,000 square-meter office complex comprising two towers, designed by Rogers, Stirk, Harbour and Partners (London).

Prologue

THE DEVELOPMENT OF WORLD-CLASS buildings in emerging markets poses complex challenges to the construction industry. Diverse teams with uneven skills must align their interests around an alien building that is introducing new materials and construction methods in an unfamiliar market. Substantial efforts are required to align design and construction teams with different origins and expertise around an integrated solution. Special caution is essential to execute, control and follow the plans, specifications and drawings that guide all actions to (hopefully) the same goals.

Cultural differences impose additional stress during the delivery and control of construction planning and cost. A labor-intensive local culture

will clash against a global construction logic based on design + shop-drawing + fabrication + installation sequences that increase accuracy and integration requirements. The paradox of introducing global knowledge into local markets has to be solved, avoiding oversimplified solutions that ignore the local context. Plans and specifications delivered by designers in a market that is not fully developed will greatly differ from the design scope of large-scale international projects. However, in countries with a local practice used to rapid growth, such projects will encounter local design teams demanding involvement beyond the successful compliance with local regulations. On the other hand, local suppliers not well equipped for complex construction tasks do have significant labor capabilities that are greatly needed. Local construction companies that are not used to conducting preconstruction services, such as thorough constructability reviews and detailed planning exercises, may find themselves in leading roles. Success is determined by the ability to add additional forces.

To succeed in delivering complex projects in emerging markets requires collaboration and communication. Innovative team building centered on advanced communication techniques may foster precise roles and mutual trust. Conveying meaning instead of transferring information may challenge managerial capabilities. Team integration, strict communication protocols and mutual trust are critical conditions for successful delivery of integrated projects in complex environments.

Project delivery conditions in emerging markets

HISTORICAL CONDITIONS OF BOTH local design development and the local construction industry determine project delivery – its conditions, capacities and success. In emerging markets such as Colombia, the 'local' construction sector has had sporadic exposure to international markets. This has made for a strong local culture and familiar project delivery procedures, developed to suit a specific context. This has resulted in the development of specific means, methods and features within the local economic frame, making the most of the circumstances available. Sometimes this has resulted in interesting creative solutions based on the use of local materials and technologies, and sometimes it has resulted in inadequate development for complex projects. A quite isolated status with poor research and development policies

impacted the construction industry, the capacities, efficiencies and performances of such markets. However, the tide is turning. Extraordinary economic growth is changing this situation rapidly in places like Colombia.

Despite the fact that Colombian R&D investment is very low, local materials and technologies have been subject to some innovation and development by means of the scarce efforts of research centers associated with universities. In some cases private initiative from designers and/or construction companies also promoted hands-on practical solutions to specific needs that stimulated innovative practices, either by introducing proven foreign solutions locally or by developing particular solutions specifically designed for the local realm. This is the story of a private effort to make steps towards a needed innovation in order to deliver the kinds of buildings that will be appearing in Colombia in the years to come. This wave of private-induced innovation took place for the first time during the heroic "modern" times around the middle of the twentieth century, where the first architects and engineers who earned degrees in the recently founded Colombian universities acted as pioneers for the introduction of modern ideas to Colombia. These construction companies were the founding fathers of modern building in Colombia. Unfortunately, not all of them succeeded in surviving the next generation, which meant a significant loss for the local construction culture.

Colombia's modern construction via do-it-all companies

Colombia's National University offered a degree in architecture for the first time in 1936. Other institutions, such as Universidad de los Andes (private) and Javeriana (religious), opened faculties 10–15 years later. This new condition, together with already well-established civil engineering faculties, helped to shape an important number of local professionals ready to undertake their mission: to give shape to modernity in the country.

The construction industry, still attached to neoclassical facades supported by hidden reinforced concrete structures, started to develop modern buildings. The basic modern questions were addressed: efficiency, prefabrication and structural expression. Major construction companies had also developed design capabilities in-house: an interesting mixture of architects and engineers dominated the arena. The model of a design + construction company was established early in Colombia, with pros and cons: more integration, less specialization.

With significant access constraints to an international market of goods and services, a reinforced concrete technology is mastered by locals based on local design capabilities both in engineering and architecture, together with a concrete supply industry sufficiently developed, and a local low-cost brick supply that evolved during the nineteenth century. However, introduction of prefabricated elements from windows to drywall was scarce and limited to local inventiveness.

New capacities to introduce steel structures in buildings and high-technology aluminum-glass would come much later, as exceptions to the norm. The local building codes evolved to respond to a reinforced concrete type of building, in most cases covered with local masonry. International construction companies specializing in deep foundations, tunneling and other infrastructural projects were involved in public works, and made some impact allowing the development particularly of the design of deep foundations capable of performing for high-rises developed in the 1950s and 1960s.

Change of paradigm: mortgages and loans gave birth to developers

Colombia restructured the financial system in 1972, providing a new mortgage and loan regulation that increased tremendously the amount of financial resources for housing and other real estate endeavors. Developers then took control by exploiting privileged market decisions and sacrificing bold innovative proposals for already proven solutions. Construction companies started to work for developers, or introduced developing capacities in-house to survive. This changed the nature of the industry, where a conflict of interests and the expected competition among different companies did not foster innovation.

Modernity failed to provide better conditions to the majority of the people, but certainly introduced modern methods with local resources, allowing the possibility of trying audacious projects. This wave broke quickly and for good after 1972, with a new figure in charge of the vision and management of projects: the developer.

Current status

Major construction companies involved in real estate projects to be offered to the market adopt tasks such as securing land, defining the value proposition of a real estate project, guiding marketing, and developing and designing

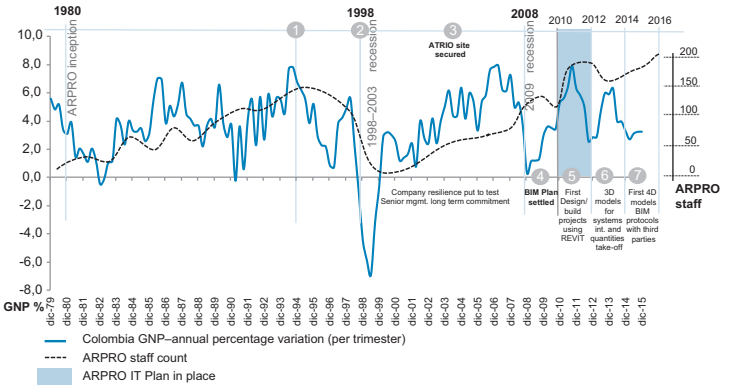
their projects either in-house or by outsourcing. Projects usually are presented to the market with only one face: the developer-construction team, with perhaps one or two consultants at the side. Certainly, this approach could foster integrated delivery practices together with other innovations. The reality is that post-1972 very few invested time and effort to consider adjustments to the typical contractual structure, the well-known recipe of materials and methods, or the ruling management practice. However, some are making efforts to keep pace with emerging technologies to be applied in this industry: many are CAD-oriented, but lack comprehensive understanding about 3D approaches and BIM environments.

Smaller construction companies use a different approach where a new developing company is established for every specific project, usually with the same name of the building being developed. These companies vanish once the building is delivered, making any claim a major effort for the end user. Bad idea. But pirates have been out there since ancient times. Let us focus on the companies that are there for the long run.

The ARPRO case

ARPRO WAS ESTABLISHED in 1978 in Bogotá, Colombia. The original plan was to offer design and construction services to the local market. The company managed to secure increasingly complex construction contracts, allowing a steady growth of the business. The company also started to develop its own projects as a means to survive in a market where all important construction activities were performed by the same developers, which actually did not allow a sound construction services market to be formed.

In 1998, ARPRO had a significant number of projects in the market. A major economic recession took place in the country, threatening the future of the company. The 1998 financial crash was quite severe, and exposed both buyers and developers to unreal financial conditions where, for example, a regular mortgage duplicated the value of the asset. New buyers disappeared; companies with stock in the market and conducting construction were to complete and deliver buildings in terrible financial conditions. Banks flourished, certainly. Construction activities came to a complete standstill.



9.1 ARPRO timeline from 1998 construction crisis to the present day

By the end of 1998 ARPRO had delivered all pending projects and paid all its obligations, assuming a ten-year debt. Many other companies defaulted and disappeared. Those ten years put ARPRO to the test on entrepreneurship, trust and determination. The company was able to retain key staff members and showed a remarkable resilience by getting involved in public works, such as public space renewal and bus station construction. The debt was paid off in 2008, only to find that a new recession was starting in Colombia. This time ARPRO was in much better shape, with all real estate developments duly financed, and actively participating in a unique, strategically located renovation project. The project, Urban Plaza, involved a major effort to secure the land without expelling the original landowners, and including them as passive partners in a large asset delivered to the market in 2013 (Figure 9.1).

This new challenging phase for the company triggered several strategic planning exercises where a full commitment to new tools to enhance productivity was settled. This commitment was seen as the path to survival and growth. Younger team members aware of lean construction, BIM protocols and 3D software prepared a four-year plan of action involving important resources. The solid financial status of the company allowed the business to secure funds for the change. The following timeline shows the development of these turbulent times (Figure 9.2).

9.2 1998 – Urban Plaza before and after

The introduction of lean and BIM protocols simultaneously created quite rapidly a 'change of mood' both in the main office and on the construction sites. Launching strategies and protocols to be implemented both on site and at the main office secured success. Involving all relevant team members at different levels of the organizational chart awoke an appetite for new practices across the whole organization. Discussions on accountability were naturally happening. More important, planning exercises during preconstruction stages started to be considered instead of just executing on a daily basis with poor planning schemes. A desire for change permeated the company. People were engaged. People are the ones who make change possible, not the chief operating officer (COO).

Extraordinary projects, extraordinary partners

IN 2006 ARPRO SECURED a unique piece of land strategically located at the gates of downtown Bogotá together with other major developers and investors. The project was headed by one of the founders of ARPRO, who secured Rogers Stirk Harbour and Partners as the architects for the ATRIO project in 2008, with a very precise demand. ATRIO had to be a project capable of transforming the city surroundings. This audacious complex of two high-rise buildings and an art and events venue features a unique public space with a series of plazas, pedestrian pathways and extraordinary landscaping unseen in the history of the city. The decision to avoid a retail platform is central to the value proposition. This project will change Bogotá's downtown pedestrian system for good, creating a destiny that celebrates citizenship, entrepreneurship, art and open space (Figure 9.3).

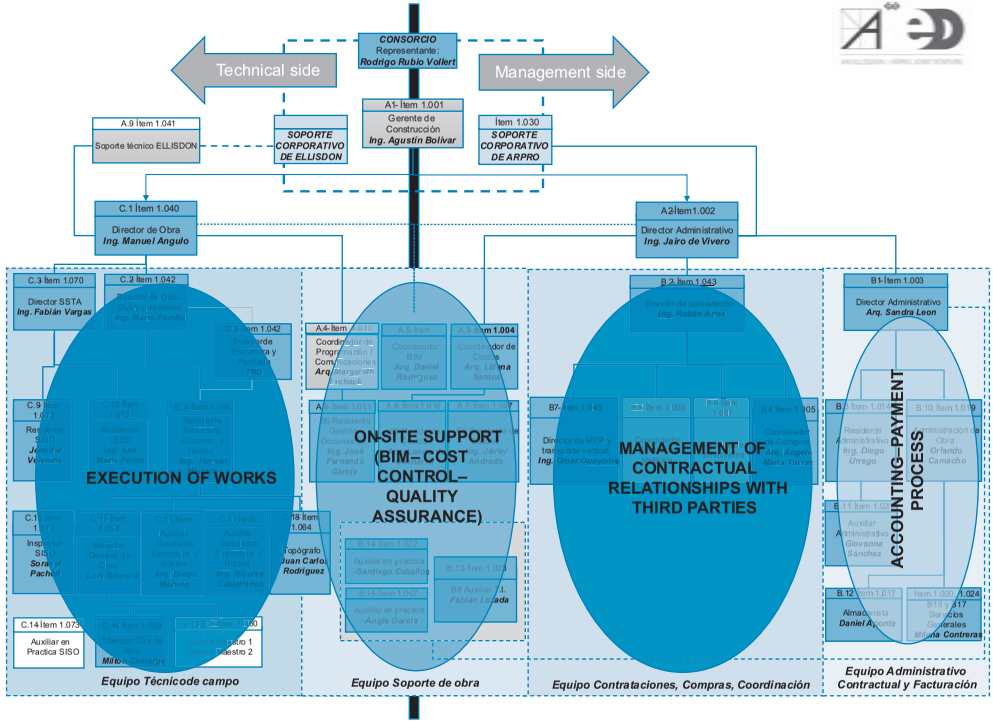
What are the challenges that a company based in Bogotá faces by developing a project designed in London? Local expertise of steel structures is limited, and no one has ever attempted to build a steel structure high-rise where the steel members are part of the architectural expression. The level of detail and

9.3 ATRIO development, Bogotá; to be delivered in 2019 (Phase 1)

the expected result are, of course, world-class. ARPRO also recognized that the organization had no previous experience in the key performances required for such a project. Very early a decision was made to establish a joint venture with an international company that was willing to come to Colombia for a long-term relationship, bringing in much needed experience. After a long selection process, 12 different companies from around the world were approached. ARPRO celebrated in 2014 a joint venture with ELLISDON Canada (AED) to provide construction services in Colombia. The first project was ATRIO.

This joint venture (JV) was conceived as a mutual endeavor between equals, where each organization contributes with its best knowledge to a common effort. The local conditions that shape the deep foundation/excavation/basement construction process, among other local conditions, such as labor, local procurement and selection of sound suppliers and subcontractors, were part of ARPRO's expertise. The planning tools, steel structures' high-rises, international procurement capacities and high efficiency standards were part of ELLISDON's expertise, among others. Availability of a Spanish-speaking team also allowed a swift and effective integration of the new group, and was key to making the final choice of partner. A shared set of values between ARPRO and ELLISDON predicts a good chance of success.

The project organizational chart (Figure 9.4) is based on common practice in Colombia, with a heavy interaction of several trades that could



9.4 ATRIO organizational chart

have been more suitable for a project of this kind. However, innovation comes like children, one at a time (two sometimes) if you do not want the parents to go crazy. So, the JV adapted itself to this particular condition.

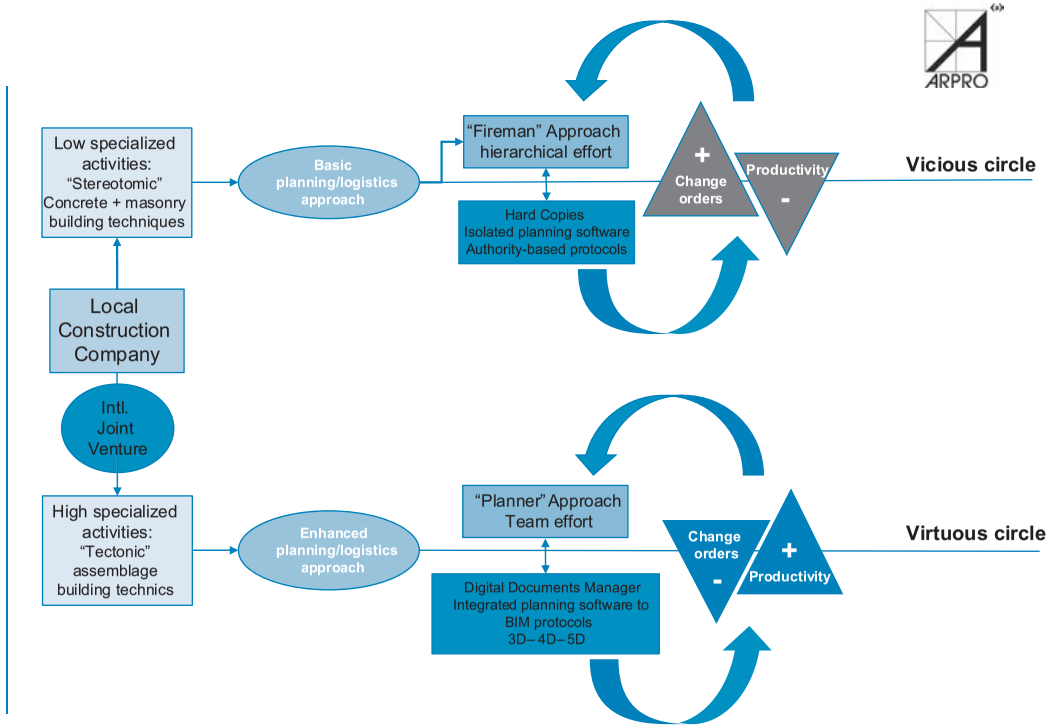
Terms and conditions of this joint effort include a commitment to precise and deep planning techniques (mandatory for these buildings, which in turn takes BIM protocols to another level), commitment to strict management techniques regarding plan and drawing submittals, change order controls, site instructions, shop drawings and so forth, and commitment to foster a solid integrated team that is capable of solving challenges emerging from two different cultures approaching the same task (see Figure 9.5 for an overview).

None of these steps would have been possible if ARPRO had not previously put effort towards strategic planning and the implementation of contemporary management tools. The commitment done during the strategic planning sessions back in 2010–2012 prepared the ground for these new challenges. The ARPRO team quickly understood the importance of this partnership for our future endeavors.

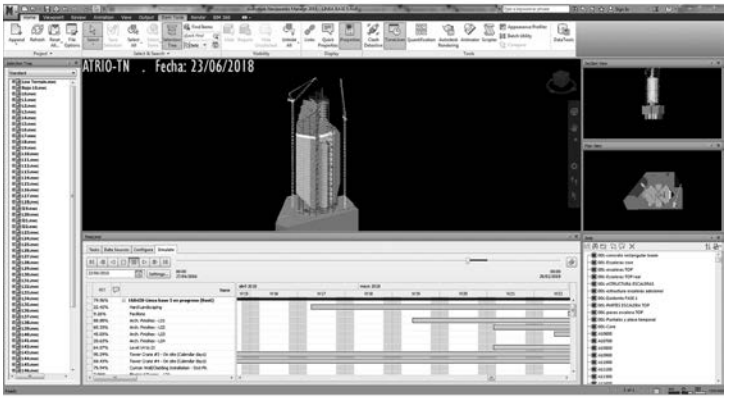
Joint efforts changed the way

SPECIAL PLANNING TECHNIQUES: The JV committed to use BIM protocols to visualize planning strategies. Visualizations are a key success factor when different teams are working together. Expediting the presentation of different approaches was of the utmost importance. The site team included a BIM coordinator, a young Colombian architect savvy about 3D software and fluent in spoken English, so that ELLISDON support landed easily on site. Again, people are the ones who make the difference.

ATRIO 3D model development was a responsibility of the local company in charge of MEP design and building integration systems (see Figure 9.6). AED offered a close supervision of the 3D model in its different stages to assure that the model parameters would allow the construction team to make proper use of the model, proceed with 4D exercises, obtain quantities and identify construction progress. Those three objectives were defined early in the process as the desired and, more importantly, feasible goals. For the first time in our country, a construction team is developing planning scenarios in a 3D/4D environment.



9.5 ARPRO innovation chart



9.6 ATRIO, example of schedule engaged with 3D model

Conveying meaning: ATRIO construction process is completely different from the current local construction culture: it is based on the "assembly" of elements fabricated off site compared to the "addition" method of reinforced concrete and brick envelope. The steel structure and curtain wall building is certainly dominated by a much larger set of instructions. Adding the (not so desirable) practice of fast-tracking the project has resulted in issuing several versions of plans and drawings during the works (which is the case for the first phase of ATRIO), and it is clear that the number of plans and drawings to be managed is quite large.

Conveying meaning instead of transferring information was a major concern, and certainly a way to raise managerial capabilities. AED designed early in the process a complete protocol for submittals and information access that has been implemented mercilessly. After educating all our designers on how to prepare a PDF format type of plan, we developed a special template on a PDF reader software with extended programming capabilities, allowing the construction team a swift and efficient way of consulting all information available by means of hyperlinks attached on every plan where a reference to another document exists (see Figure 9.7). For the first time in our company, we have a controlled database of valid plans and drawings that updates automatically all revised versions, indicating in red any change made by consultants. This is a must for fast-track projects anywhere.

Access Screen

ATRIO on-site Digital Information Room

9.7 ATRIO Sala Digital

One team: A joint venture always poses a major challenge for the client. There is always the big JV question in the air: Is what we have now one solution or two problems? The only way to make the JV a real solution is to achieve an integrated team that acts as one entity. This is hard to accomplish. There is certainly no final prescription to solve this puzzle. It is an evolving

landscape that encompasses the complete work experience from beginning to the end. It requires similar abilities to those of the anesthetist:

- A fair amount of sensors indicating the status of the patient.
- Several mechanisms to keep the patient asleep (so that the operation may occur), but in the right dose to avoid death.
- The ability to bring the patient back whenever needed to jointly discuss the procedure and confirm if anything else is needed, always in a controlled environment.

Allow me to report from the front: AED is currently healthy and working fine. The main reasons for this appear to be related to:

1 Language. The ELLISDON staff deployed on site is fluent in Spanish. We are not getting lost in translation.
2 Roles. Everyone knows clearly what is expected from him or her, and knows who is in charge at each level of the organization. However, authority comes from knowledge and performance.
3 Trust. No one is imposing anything; decisions are to be made after a complete understanding of the different approaches, always aiming at how to deploy the best possible ideas in an environment with specific opportunities and limits. This may take time. However, everyone knows that his "gang" is not capable of delivering without the help of the other "gang". It is a case of "trust, hear, persuade, learn, accept or perish".

We have been successful so far in promoting a discussing-learning-deciding atmosphere, based of course on the fragile but resilient human need to interact, belong and succeed.

Final remarks

OUR COMPANY HAS FACED many different challenges in recent years:

- Building with alien materials and systems (Rogers Steel Structure architecture) that change the local building means and methods.
- Finding a partner willing to join efforts with a long-term view.

- Raising managerial capabilities to adequately receive and submit instructions to consultants, subcontractors and clients.
- Introducing state-of-the-art software technologies that allow detailed modeling of the construction works.
- Interacting with both local and international consultancy and designers.
- Changing the local construction mindset from being a "fireman" constructor (who gets medals from solving the day-to-day problems) to a "stick to the plan" kind of constructor (who gets medals at the end of the project).
- Being able to impact other projects and business lines of the company with the knowledge that is being made available after accepting the foremost challenge of all: change.

Further reading

There are a small number of books that are specific to design managers working in the AEC sector. Parallel to this is a larger body of generic material on design management. To help readers I have included the titles that my students and I have found insightful, together with a very brief overview of some of the early books on the subject. There is also a note about the peer-reviewed journals should readers be contemplating a more detailed investigation into the subject area.

Design management for AEC

EARLY PUBLICATIONS IN the field include the work of Brunton et al. (1964) and Emmitt (1999) in architecture, and Gray and Hughes (2001) in construction:

- Brunton, J., Baden Hellard, R. and Boobyer, E. H. (1964) *Management Applied to Architectural Practice*, George Goodwin for The Builder, Aldwych.
- Emmitt, S. (1999) *Architectural Management in Practice: A Competitive Approach*, Longman, Harlow.
- Gray, C. and Hughes, W. (2001) *Building Design Management*, Butterworth-Heinemann, Oxford.

There are four books that, combined, cover a wide range of issues from a variety of perspectives. Readers with backgrounds in architecture, engineering and construction should find them informative:

- Emmitt, S. (2014) *Design Management for Architects* (Second edition), Wiley-Blackwell, Chichester.

- This is written for students of architecture and contains two interrelated sections, managing design projects and managing design offices.
- Emmitt, S. and Ruikar, K. (2013) *Collaborative Design Management*, Routledge, Abingdon.
- Written for students of construction design management, the emphasis is on demonstrating the value of design to constructors.
- Eynon, J. (2013) *The Design Manager's Handbook*, Wiley-Blackwell, Chichester.
- Written for practitioners working with design management. This handbook provides a broad assemblage of ideas and guidance.
- Sinclair, D. (2011) *Leading the Team: An Architect's Guide to Design Management*, RIBA, London.
- Written for architects, the focus is on the principal designer more than the design manager, although the roles are similar.

Generic design management

EARLY PUBLICATIONS INCLUDE Farr (1966) and Cooper and Press (1995), and more recently Best (2010):

- Best, K. (2010) *Fundamentals of Design Management*, AVA Publishing, Lausanne.
- Cooper, R. and Press, M. (1995) *The Design Agenda: A Guide to Successful Design Management*, Wiley, Chichester.
- Farr, M. (1966) *Design Management*, Hodder and Stoughton, London.

See also the homepage of the Design Management Institute, www.dmi.org.

Peer-reviewed journals

VERY FEW PEER-REVIEWED academic journals regularly publish research about design management in architecture, engineering and construction. One exception is *Architectural Engineering and Design Management*, published by Taylor & Francis. This journal has published research articles concerning aspects of design management regularly since its launch in 2005. See http://www.tandfonline.com/taem.

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